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Editorial.

Research and Propaganda. The Government Department of Agriculture in each province consists of two wings, one dealing with research and the other with propaganda or the dissemination of the results of research. In our province though the propaganda branch did exist from the very early days, the organisation of research on the different branches of agricultural science was set on foot with the opening of the Institute at Coimbatore in 1908. The work at the Institute, is supplemented by the work at a number of agricultural research stations, scattered over the different parts of the province where special practical problems of local interest are tackled. For propaganda work the province is divided into eight circles, each consisting of a few districts. The propaganda work is in the immediate hands of a number of agricultural demonstrators, roughly one for each revenue taluq of a district, and the demonstrators are directed and controlled by the Assistant and Deputy Directors of Agriculture, who have charge of districts and circles (number of districts) respectively. Each demonstrator has a trained maistry to help him.

It must be admitted that research must precede propaganda as otherwise there will soon be reached a stage when there will be nothing new to do propaganda about. The results obtained from research are recorded in the several departmental reports, leaflets, and

bulletins and the function of the propagandist is to remain in active touch with the research work, and whatever result has passed the experimental stage, to take it up and carry on propaganda to influence the ryots to make use of such result in his practical farming. The success of the propaganda will be measured by the number of people who actually adopt the practice recommended. It has been the experience in Madras as in any other province, that the actual demonstration of the improvement advocated in the ryots' own lands carries greater weight with him than any other method. The ryot is always inclined to consider the results obtained at the Government stations with a certain amount of suspicion because of the special equipment and facilities which these stations command and which he lacks.

It has been declared by people who are competent to speak with authority on the subject, that the standard of research work in India in general, and in Madras in particular, is fairly high but still propaganda has not kept pace with research. Advance has been greatest only with the spread of improved strains of crops because even without elaborate propaganda the ryot realises that better seed produces better crops. Members of Legislature often point out at the Council sittings that the results of research have not reached the masses but this cannot be true so far as the seed distribution work is concerned. After all the main object of research work is to evolve better varieties of crops, better methods of cultivation, better methods of manuring the crop and better methods of combating insect and fungus pests, so that by adopting them the cultivator stands to gain. There are instances where some of the improvements that had past the demonstration stage long ago have not yet reached the remote corners of a tract for which such improvements were intended. It is very rarely a research officer combines in himself both the capacity to do research and present the results of his work in a popular way which the ordinary cultivator can understand and adopt. His work is mostly in the laboratories and in the experimental stations. The success of the dissemination of the results of research, consequently rests with the agricultural demonstrator, whose work is in the villages. While the former deals with plants and soils, the latter has to deal with men. Capacity to persuade and convince the ryot, patience and unbounded faith in what he is advocating should form the necessary qualifications of a successful demonstrator. He should have as it were the right missionary spirit in him The peasants and cultivators are mostly illiterate and they are not going to benefit by any amount of literature that might be published on the merits of any particular agricultural improvement. The demonstrator has to utilise to the full the opportunities he gets to come in personal contact with the people in the village and discuss with them their problems. We are sure that in Madras the demonstrators possess all the necessary attributes in a

high degree and if still greater progress has not been achieved the fault certainly lies not with them. It is probable that among other things the methods of propaganda so far pursued are such that the ordinary cultivator cannot appreciate or be convinced of the value of improvement advocated. Propaganda is a science in itself and research work is necessary to adapt it to the circumstances.

The methods of propaganda have to be revised as experience accumulates. For instance in Madras the Central Village System was introduced in 1930 whereby the demonstrator confined his work to three or four Central Villages in the taluq, visiting other villages only occasionally when his help was asked for. It was expected that he might be able to get about 50% of the villagers in such centres to adopt the improvements advocated and then he could shift his activities to some other centres. The results, however, were not satisfactory in that the expected number of people in these villages did not take to the improvements and the demonstrator was losing his general touch with the taluq. It is likely, there is a limit up to which only, a village could be made to take to new ways. The method of work has recently been modified so that each demonstrator has to work in eight to ten central groups of villages, each group consisting of five adjoining villages. If in a period of time, say three years, the improvements advocated are adopted by a fair number of people the demonstrator could move his activities to another group of villages. There is also a proposal to be tried as an experimental measure to place each group of villages in each taluk of a selected district in direct charge of a demonstration maistry who has had some general education, say up to the School Final standard, and has received special training in one of the Agricultural stations.

The use of cinema in agricultural propaganda has been successfully adopted in some of the Western Countries like Italy and Russia and it is probably one of the things that may be worth trying in India. The grant of *taccavi* loans expeditiously for buying agricultural implements, strengthening the demonstration staff particularly the number of demonstration maistries, use of exhibition vans, making greater use of the newspapers, offering attractive prizes for carrying out agricultural improvements, and use of the drama and songs are other methods suggested to intensify the propaganda and some of them are even now being adopted. The service of broadcasting for the purpose of agricultural and rural reconstruction propaganda has recently been introduced by the Agricultural Institute of Allahabad. To attain the maximum benefit out of the several methods, the present system of education in the country has to be completely recast and reorientated. It is no exaggeration to say that there are graduates of the University who do not know how the rice plant is actually grown, although rice forms their staple diet day in and day out. The education has all the

time been literary and tending to take boys away from their natural surroundings. There is a great deal of force in the suggestion made that an agricultural bias should be introduced in the Elementary education and that agriculture should form one of the subjects of the Secondary and High school education. Though agriculture may be a vast subject, the principles of biological science as applied to agriculture could be easily taught at quite an early stage. It must be remembered in this connection that there is a great need for suitable elementary text books written in vernaculars for the use of the boys in the Secondary and High Schools.

It is due to the importance of propaganda methods that this subject is included in the agenda of every Board of Agriculture meeting. Though the general methods of getting into touch with cultivators may more or less be the same in every province, discussion of any special methods of propaganda successfully adopted in any particular province might be of benefit to others. This subject had been referred to a very strong and influential sub-committee at the recent Board of Agriculture which met in Delhi. There were a number of notes prepared by officers in the several provinces giving their experiences and the committee after going through the notes, formulated certain definite recommendations which were adopted by the General Board. The full recommendations adopted are given separately as proceedings of the Board of Agriculture published elsewhere but particular attention might be drawn to some of them here. One of these was that " the propaganda relating to all the departments dealing with rural development should be co-ordinated and the Provincial Governments should entrust a special officer with this duty and also with the duty of intensifying propaganda work in the Department of Agriculture ". They have also recommended in this connection " that the Imperial Council of Agricultural Research should be asked to undertake a study of propaganda methods in India and other countries and circulate the information obtained from time to time to all provinces and states concerned ". All the Provincial Directors of Agriculture were unanimous in welcoming this recommendation. They felt that though the present Deputy and Assistant Directors of Agriculture were actually engaged in propaganda work, a special officer was necessary more in the way of advertising the work of the Department. He could, if necessary be termed a Publicity Officer, and he could in addition to the writing of popular leaflets on the results of research by keeping himself in close touch with the propaganda staff on one side and the research staff on the other evolve new methods of carrying on propaganda. The Indian Central Cotton Committee has now got a Publicity Officer among its staff and has been keeping the people in the know of what all is being done towards the improvement of cotton in the various provinces. There is no doubt that a

specially selected and suitable officer entrusted with this work in every agricultural department will be able to write popular and simple brochures in the several vernaculars of the province.

Another recommendation was "that the State should encourage agricultural graduates and educated youths with practical agricultural training to settle in cultivable waste land and conduct agriculture on improved lines and in order to enable them to do so on an economic basis, the State should give them such financial help as may be needed for the initial reclamation of the land and also lend on easy terms the capital required for carrying on the Industry."

This scheme is already under trial in Mysore, Travancore and the Punjab. The Directors of Agriculture concerned were definitely of the opinion that the experiment was proving a success. The experiences of Punjab might be mentioned as particularly interesting. It appears that to create what were known as model villages, grants of land were made to graduates in Arts and Sciences on the recommendation of the Principals of Colleges. Among the grantees there were three agricultural men. The main conditions of the grant were that the grantee should cultivate the land himself and should live on the land itself. While the non-agricultural men found it difficult to settle on the land, the three agricultural men did remarkably well and demonstrated what could be done. Since then a number of the junior subordinate agricultural men who had to be sent away on account of retrenchment in the staff was each provided with fifty acres of land in the Canal Colony under the same conditions and every one of them had made good. Their cultivation was a model of what should be done and it appears the Punjab Government is now considering proposals to extend this scheme. The educative value of such farms run on improved lines in the midst of ordinary cultivators cannot be over emphasised. There cannot be a better demonstration of the improved agricultural practices for the ryots to observe and copy. Will it be too much to expect that Madras might take a lesson from Punjab in this matter? The present Director of Agriculture, who is enthusiastic and alive to all new ideas will, we hope, be able to initiate a similar scheme for this province. There is already a certain amount of unemployment in the ranks of agricultural graduates and this will be an excellent opportunity to initiate the scheme. The other day several of the members of the local Legislative Council pressed on the Government the idea of making better use of unemployed agricultural graduates by settling them on land as private farmers. Suitable blocks of land under the Mettur project area in Tanjore should be available to start this experiment and with the experience gained, the experiment might be modified if necessary and expanded when the Tungabhadra project is completed. In this connection we would like to draw the attention of the readers to a scheme for relieving unemployment

published elsewhere in this issue. The proposal certainly deserves encouragement.

The third recommendation to which attention might be drawn was " the preferential employment of agricultural graduates in Departments of Governments other than Agriculture such as Revenue, Co-operative, and the Irrigation Departments as their agricultural training would make them specially effective in the discharge of their duties ". There is no doubt that this recommendation would be welcomed by all people interested in the advancement of agriculture. In olden days when the Agricultural College was located in Madras, the policy of Government was to depute selected men from the subordinate staff of the Revenue Department in each district to undergo training in agriculture. Several of these men after going back, had done exceedingly well and to quote only one example we might mention the name of the late Rao Bahadur Dharma Ranga Raju. It used to be told that as a Deputy Collector, whenever he went on camps he took with him improved ploughs and demonstrated their use to ryots. We are sure that in all Departments where the officers have to come in contact with the ryots, the employment of agricultural men should be of immense use as it should then help in the dissemination of knowledge about agricultural improvements.

SATHGUDH—THE HOME OF SATHGUDI ORANGES

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Introduction. SATHGUDH (Sath=seven, Gudh=hillocks with forts) the place after which one of the best varieties of South Indian oranges is named, is now a hamlet of Pernambut Village, in Gudiyattam Taluk, North Arcot District. The remains of the seven hill fortresses are still seen on the tops of hills surrounding the village, the village proper being situated in the centre of a valley. Sathgudh, now generally known as Satghur, is on the Pernambut-Synagunta forest road, a mile from Pernambut and the nearest railway station Mailpatti, on the Madras-Bangalore line, is eight miles away from the place.

Originally it was the head quarters of the taluk of the same name, but now it has been reduced to the position of a hamlet due to adverse circumstances which will be described in the course of this note.

Historical Importance. The place is interesting on account of its celebrated forts. The Jagir worth three lakhs of rupees was originally granted by the Emperor Muhammed Shah to one Hirasut Khan, who after the assasination of Safder Ali at Vellore, acted as *naib* of the minor Muhammed Ali. When the latter was assasinated at Arcot, Anwar-ud-din sent Hirasut Khan back to his Jagir. He was succeeded by his son and grandson, but Nawab Ammer-ul-Hind Wallajah usurped the Jagir and established himself as the Jagirdar. When Nawab Ameer-ul-Hind Wallajah died issueless, the British Government sold the free-hold right of the estate by public auction to Meer Oomaja Bahadur, a then member of the Madras Collectorate on the 4th May 1862 for a sum of Rs. 44,035. But owing to excessive debts contracted by his son Syed Muhammed Khan Bahadur, the estate was managed by the Court of Wards for some time and in 1924 it was finally auctioned. Sowcar Janab C. Abdul Hakim Sahib Bahadur, an influential merchant of Madras purchased it for a sum of Rs. 1,64,000. The property is still in his possession. A portion of the village belongs to Government.

The highest of the fortified peaks rises to a height of 2367 feet above the sea level, the other six being some what lower. The style of construction is attributed to the Maharattas and the existence of some Hindu temples and mantapams together with the style of the fortresses themselves, show that they were not Muhammadan structures, though signs of Muhammadan improvements are apparent. It was during the Muhammadan period that fruit trees were planted for the first time in the Village. Oranges, mangoes and other minor fruit trees viz. custard apple, wood-apple, guavas, were largely cultivated.

Agricultural importance. According to the sale deed executed by Colonel Dale in favour of Meer Oomaja Bahadur on 4th May

1862, the total area of the estate is about 6050 acres. Of this total area, about 75 acres are classified under wet, 2000 acres under dry lands and the rest under forest, river and channel beds, house sites and roads.

The soil in this village varies from light loamy soils along the river beds to deep red soils with soft rock underlying at the foot of the hills. The soil is fertile generally.

The main sources of water for the village were:—

(a) Kannar (hill stream) which flowed in the middle of the Village during rainy season from the surrounding hills.

(b) Kasams. (perennial springs) There were four in the village itself and another passed through the Village from Rengambatta, a neighbouring village. These kasams were supplying water to the whole of the village throughout the year, and water table was so high that there was no need to lift water to irrigate the fields.

But now, owing to inadequate and unevenly distributed rainfall, water supply has become very scarce in the Kannar and Kasams. A number of wells, have therefore been dug in different places in the village for irrigation purposes. Even in the wells, which now number about eighty, the water-level has gone down beyond fifty feet.

During the period of the Muhammadan rulers the Royal family evinced much interest in cultivation, especially in fruit growing. The Nawabs took up extensive lands and planted large acres of fruit trees viz. oranges, mangoes, custard apple, and guavas. Even now remnants of these plantations except that of oranges are seen in the village. Fruit gardens were planted in memory of a few important persons e. g. Dhadi Bagh, Oomaja Bagh, Ali Bagh, Beghum Bagh and Kanni Koul and they exist even now, though in a neglected condition.

The present generation have not seen orange gardens in the village, but very old people still surviving say that they had seen about 70 acres of orange gardens, belonging to the Royal family. One "Thatha Malgoa tree" seen in an old garden is more than 100 years old and represents the best variety of the locality. With the decline of the Muhammadan dynasty, the interest in fruit cultivation ceased. The lands passed into the hands of absentee land lords. None of them took any interest in fruit cultivation, and the famous Sathugudi orange gardens disappeared from their original home.

During the Muhammadan dynasty this was the best known village and large number of ryots came and settled in it. It is said that there were as many as eight streets with more than two thousand houses in the village; but as the lands passed into the hands of absentee land lords, who did not properly look after the lands and the tenants and as the supply of water in the village got scarce, most of the ryots who were residents of the Village migrated and settled down in more

flourishing villages in the neighbourhood; and there are at present only three streets with three hundred houses. The people are too poor to take any interest in cultivation and much less in fruit growing.

It is but natural that when a Royal family shows some interest in any particular occupation, the people also take interest in it; such was the state of affairs in Sathgudh during the period of The Muhammadan rulers.

It is however gratifying to note that one ryot has planted a small area of about an acre under orange in the village last year. It is hoped that this will be a forerunner to many others who may renew the old reputation of the place by extending the area and that it may again be the chief centre of producing good fruits.

The writer acknowledges with thanks the encouragement and suggestions given by Mr. M. Kanti Raj, Assistant Director of Agriculture, Vellore, in preparing this article.

FRUIT FLIES AND THEIR ECONOMIC IMPORTANCE IN S. INDIA *

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In a tract like South India where the benefits of a liberal use of fruits in the daily dietary of our households has not yet been sufficiently appreciated as in many western countries, neither the cultivation of fruit crops nor the study of the diseases and pests they are subject to has received that serious attention which such problems deserve. It is needless to add that fruit trees are as much subject to the attentions of insect pests as are many of our staple food and other cultivated crops and if one takes some little trouble to estimate the loss caused by insect pests to our fruit trees, it will be found proportionately as substantial as is the loss caused by pests of paddy, cotton and other field crops. Among the various insect pests attacking fruit trees those popularly known as "Fruit flies" occupy a very important status in all the fruit growing areas of the world. In this province, though we find different kinds of these fruit flies attacking various fruits and damage to crops is generally realised, we have hardly any previous records on the biological or economic aspects of South Indian fruit flies excepting a few references of a taxonomic nature. In these days of quick and easy transportation facilities between different parts of the world, insect pests of different kinds have more frequent and easier opportunities of getting dispersed from place to place and, in many cases, undesirable insects get admission into areas where they

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were unknown before; among such forms fruit flies play a very important role. As such, it is believed that, some knowledge of the general features and habits of these insects might be of help to fruit growers not only in South India but also in most fruit growing areas of other provinces in recognising a fruit fly pest when it appears and to adopt prompt measures to control the same. Though attention has been previously paid to these insects by the writer occasionally since 1907, a closer study of the insects was taken up only recently and in this paper are briefly presented the results of an investigation on the general features and habits of the fruit flies noted so far in South India indicating at the same time some methods to control them accompanied by an annotated list of the species of fruit flies so far recorded from this province.

General features and life history of fruit flies. Though among scientists the term 'fruit flies' is a well recognised and accepted term for these insects, a more suggestive and apter designation for them would be "fruit maggots". Every fruit grower and almost every layman is familiar with the whitish fleshy worm-like maggots often found inside healthy fruits like mangoes, guavas, etc., and knows how these maggoty fruits are unfit for consumption and do not command a sale in fruit stalls. These creatures belong to the family Trypaneidae of the insect order Diptera (two-winged flies) and the maggots boring into the fruit are the young ones of the active flies—popularly known as fruit flies. Of course, numerous minute flies are very often found hovering about various damaged fruits and decomposing vegetables and some maggots are also seen in the rotting mess; but these flies or maggots are not the real pests referred to in this paper but they are only scavengers following up rot or decomposition and do not visit sound and healthy fruits. Though fruit flies more or less resemble the domestic fly in their fundamental build and external structural features, belonging as they both do to the same order, the former are entirely different in structural details, form, color and life habits. These flies are generally short, stout built and pretty looking; they generally have the wings banded or mottled and the body has a brownish or darkish color often with markings of brown and yellow. The head and thorax bear prominent sharp bristles which are often of great taxonomic value. The male shows four and the female five segments in the abdomen; the latter has a horny ovipositor often long and conspicuous. In size, some are as big as the housefly while there are a few which are bigger or smaller. In their habits they are invariably vegetable feeders, attack healthy fruits and pass the greater part of their early life inside the host fruit. The adult fly is generally found hovering about the host plant feeding on the sweet fluid inside various flowers; it does not do any direct harm to fruits. The life history of these fruit flies is more or less similar in most cases. Small cigar-shaped

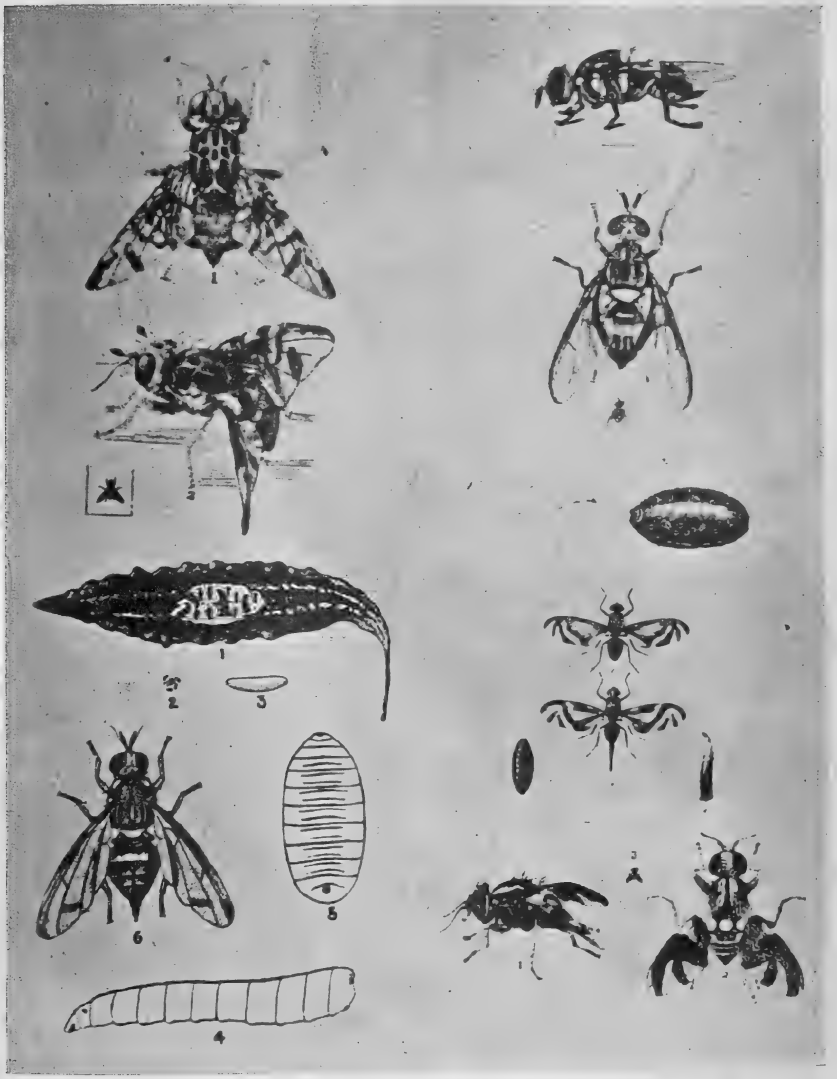
whitish eggs are thrust by the parent fly just under the rind of ripening fruits with the help of its needle-like ovipositor. The fine punctures thus made on the fruit surface become closed as the fruit ripens and an infested fruit generally appears quite sound externally until the time when the fruit gets badly bored and drops down rotting. These eggs inside the fruit hatch (which takes just three or four days) into the maggot stage and the maggots start feeding on and burrowing into the pulp of the fruit. The maggots generally vary from whitish to yellowish or brownish white according to the color of the fruit pulp they feed on; these smooth cylindrical worm like larvae are footless and measure about $\frac{1}{2}''$ to $\frac{5}{8}''$ in length. They have a pointed head and a truncated posterior end and the former shows the dark mouth parts. The larvae of many fruit flies often exhibit the peculiar habit when exposed, of bringing the two ends of the body together and jumping high into the air. The just hatched maggots inside the fruit at first feed on the surrounding tissue and gradually approach the centre, by which time the infested area quickly spreads as a putrid mass and, in many cases, causes the fruit to drop; this latter contingency varies with different kinds of fruits and their inner consistency. When the maggot is full fed it finds its way out and drops into the soil for pupation; this is generally the habit of all fruit fly maggots. The soft larva changes into a barrel shaped seed like pupa of hard consistency and has a brown or yellowish brown colour; this pupa remains in the soil until the adult insect flies out of it. Ordinarily, one generation of the fly from the egg to the adult stage takes about a fortnight or three weeks though, in certain cases, the pupal stage may be found to occupy longer periods. Due to various seasonal and other factors the insect does sometimes suffer mishaps; many maggots may not hatch due to lack of the necessary temperature especially in cold weather; many maggots may fail to reach the soil to pupate and a good many pupae may not be able to emerge as adults from the soil due to unforseen changes in the soil conditions such as heavy rains, flooding, hardening, etc. In spite of all these possible factors, their fecundative and rapidly multiplying powers, their protected condition inside fruits away from insect enemies and safe against insecticidal operations, help these creatures to maintain their important status as major pests.

South Indian fruits subject to fruit maggot attack. As a rule, fruit flies are found distributed chiefly in the tropical regions being found abundantly in Asia and Africa. They are fewer in Europe and America. In S. India we have a variety of fruits attacked by fruit flies. These fruits subject to fruit fly attacks can be brought under three important categories, viz., those consumed as fruit, those used as cooked or green vegetables and a third set including wild fruits not used for edible purposes. Under the first category--edible fruits, we have the mango, guava, jak, sapota, peaches, custard apples, loquat, oranges, Zizyphus, Eugenia, melons of all kinds, plums, perisimmon and pomelos—

all of them being commonly subject to fruit fly attacks. Coming to the second category, viz., fruits used as cooked or uncooked vegetables, we have the brinjal, tomato and cucurbits like bittergourd, snakegourd, bottlegourd, ribbed gourd, cucumber, etc. Of these, bitter gourd and cucumbers often get severely attacked in vegetable gardens. Under the third group which includes wild fruits, we have so far found fruit flies breeding in fruits of sandal (*Santalum*), *Calotropis*, *Coccinia*, *Alangium*, *Cephalandra*, *Nux vomica*, *Garcinia* and *Careya arborea* and the writer has reared a fruit fly from tender bamboo shoots also; it is very probable that many other wild fruits harbour fruit flies of sorts. Of the edible fruits in which we have not as yet met with fruit flies in S. India, the most important are the banana, figs, papaya, Bael (*Agoele*) and coffee which have been noted to be subject to fruit flies in other countries. In speaking of the food plants of South Indian fruit flies, though we find that some of the common species are found breeding on more than one kind of fruit, there are a few which have been found to confine their attention to only a single food host; well noted examples of these latter are the two species of fruit flies, one found on the *Calotropis* and the other on the *Zizyphus jujuba* fruits; these two have not been found so far on any other fruits. The melon or cucurbit fly also shows a marked partiality for cucurbitaceous fruits.

Economic status of fruit flies. Among insect pests of fruits, fruit flies occupy a very important position; for, unlike some of the other pests of fruit trees in S. India—like the mango hopper, the citrus caterpillar, the pomegranate butterfly, etc., which are specific pests confining their attentions exclusively to one or other of the various fruit crops, many of these fruit maggots attack a variety of fruits all over the world. And, unlike some of the other pests of fruit trees, Nature has endowed these creatures with some special facilities which make their depredations far more serious and comparatively difficult to check; for, these maggots bore into and remain inside fruits and as such, they are protected from outside and beyond the reach of any measures like spraying, dusting, etc.; their habitat also makes them comparatively immune to the attacks of natural enemies like parasites and predators once they are inside a fruit. In addition, they are also carried from place to place safely harboured in fruits both by human and other agencies. Their rapid multiplication and the capacity under ordinary circumstances, to pass through numerous generations in the year also help them to maintain their major status as fruit pests. Though we have no regular statistics of the loss caused by fruit flies in S. India, any one interested in this problem can easily get some idea of the substantial loss caused to fruit growers and sellers if he visits some of the mango and other gardens in Salem, Bangalore, Chittoor, Alamanda, Panayam, etc. In other countries like S. Africa, Australia and the Mediterranean region, the loss caused by fruit flies to oranges,

Plate I. Some notorious Fruit flies of the world.



Left top—Two views of the Mediterranean fruit fly (*Ceratitis capitata*, W).

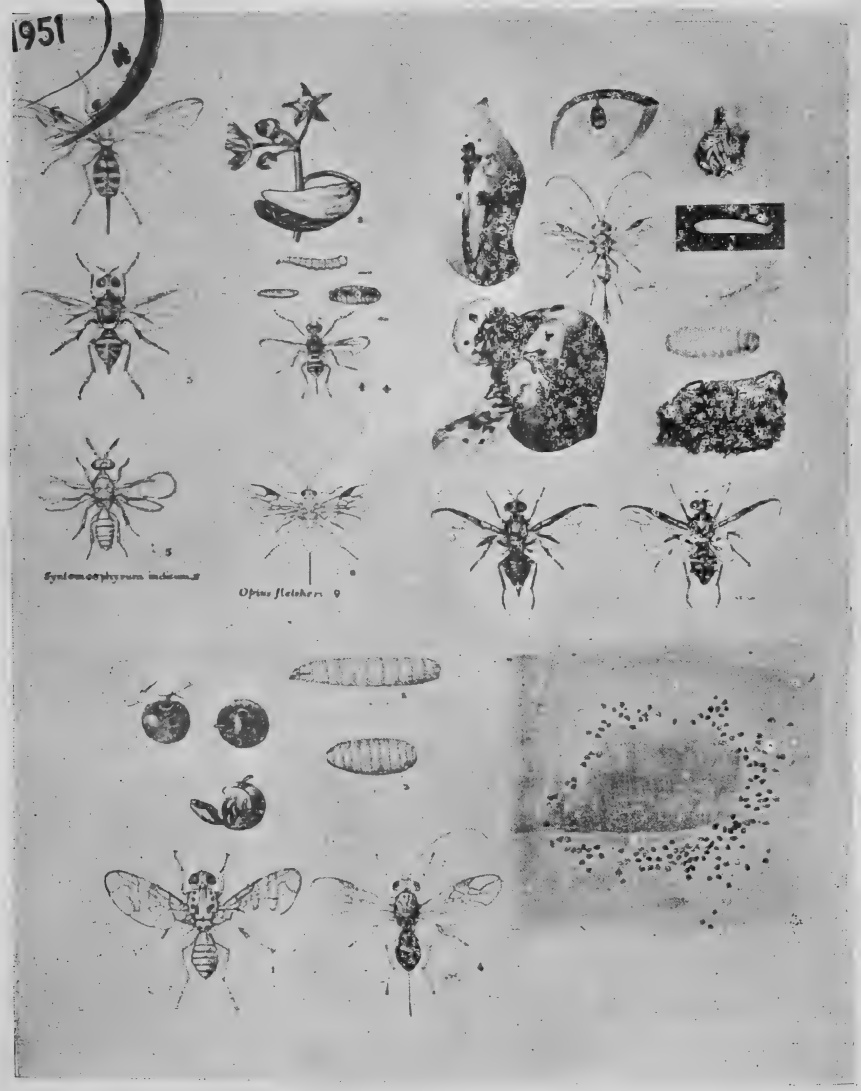
Left bottom—The Indian melon fly. Figs. 1 & 2—eggs in bitter gourd, fig. 3—magnified egg, fig. 4—maggot, fig. 5—pupa and fig. 6—fly.

Right top—Two views of the Queensland fruit fly (*Chaetodacus tryoni*, F), maggot and pupa.

Right middle—The Mexican fruit fly (*Anaestrepha ludens*, L) male, female, maggot and pupa.

Right bottom—Two views of the American apple worm-fly (*Rugoletis pomonella*, R).

Plate II. Some Indian fruit flies and their parasites.



Left top—Fig. 1—The Calotropis fruit fly (*Dacus longistylus*, W), fig. 2--damaged Calotropis fruit. fig. 3—Guava fruit fly (*Chaetodacus incisus*, W), fig 4—different stages of the Three-striped fruit fly and figs. 5 & 6-two parasites fruit flies.

Left bottom—Figs. 1–3—Different stages of the Zizyphus fruit fly (*Carpomyia vesuviona*, Ac.) and attacked fruit, and fig. 4—parasite.

Right top—Different stages of the Mango fruit fly (*Chaetodacus ferrugineus*, F) eggs, maggots, pupa etc , damaged mango fruits showing eggs and maggots, a parasite and male and female flies.

Right bottom—Peach fruit flies attracted to Citronella oil (Chemotropism).

olives, peaches, etc., has been enormous as may be judged from the various strict control measures adopted by the Governments of these countries in connection with fruit pests ; a reference to this is made in a succeeding para.

Control Measures. As stated above, these insects are borers and feed from inside the fruit; as such, control measures against these creatures consist almost entirely of prophylactic methods directed in the first place to prevent the parent fly from breeding and secondly not to allow the maggots in the affected fruits from emerging out as adults and starting a fresh generation. The more important of these preventive measures consist in keeping the fruit garden thoroughly clean and sanitary by the gathering of all fallen fruits and disposing them off either by deep burial, boiling or feeding hogs or domestic poultry with them when possible, by not marketing suspected fruit which would help in the dispersal of the pest and collecting or trapping the adult flies and destroying them.

In addition to such clean culture campaigns, the trapping and destruction of the adult flies is also done by using a poison spray ; this latter generally consists of sweet syrup (molasses usually) mixed with some poison salt such as Sodium or Potassium arsenate often spiced with some fruit juice. These mixtures are sprayed over the foliage in orchards where the fly is a regular pest ; the flies lap the droplets of the poisoned syrup and drop dead. It has also been found that substances like Kerosene, Clove oil, Citronella oil, Eugenol, etc., have also some attraction for some of these fruit flies. Howlett (1912) succeeded in attracting two species of Indian fruit flies (*Chaetodacus zonatus* and *C. diversa*) with citronella in Pusa ; but all the flies attracted were found to be males. In S. India we have attracted different species of Chaetodacus (*ferrugeneus*, *diversus zonatus correctus*, etc.) with citronella, clove oil, isoeugenol and ocimum flowers. The Mediterranean fruit fly (*Ceratitis capitata*) appears to have some attraction for kerosene. As far as we know, trials with attractive chemicals do not appear to have given very encouraging results anywhere since in some of these cases only the males are trapped, and not the other sex. It is believed that the male is attracted by some ingredient in these volatile oils which is exactly similar to the smell of its female mate and that this tropism is the result of a natural adaptation to bring the sexes together. Very little work, however, has been done so far in this interesting line.

In different parts of the world, enthusiastic entomologists have also attempted biological methods of controlling fruit flies with the natural enemies of these insects. In 1907, at the instance of the then Director of Agriculture, the writer made a tour of the different tracts like Cuddappah, Kurnool, Anantapur, Coimbatore, etc., to note fruit

flies and look for parasites ; and as a result of this tour and later studies he has been able to breed a few of these natural enemies from the common fruit flies found on melons, guavas, zizyphus and mangoes (Ramakrishna Iyer, 1927). A list of the parasites so far noted on fruit flies in S. India is added to the list of fruit flies and given at the end of this paper. During the same year, the writer also helped the well-known Californian parasite collector Geo Compere to collect specimens of these parasites especially the small dark chalcid (*Syntomosphyrum indicum*, S.) which was described by Silvestri as a new species from guava fruits in Bangalore gardens and carry thousands of them alive to Australia. Unfortunately, the writer did not, however, have sufficient opportunities to make any serious trials with the natural enemies of fruit flies. Trials have been made in this direction in different parts of the world, especially in Hawaii, South Africa and Australia by enthusiastic and earnest workers ; though such trials have added very considerably and substantially to our knowledge of the bionomics of fruit flies and their various natural enemies, there is considerable difference of opinion as to the real benefits derived from such methods in checking fruit flies—particularly because of the numerous complexities and varying climatic and other conditions which such biological methods have often to contend against. Prominent among those who have carried out work in this direction with great optimism is Professor Silvestri of Italy and his report on his expedition to Africa on behalf of the Hawaiian Board of Agriculture is a very substantial contribution to our knowledge of fruit flies and their natural enemies. Dr. Fullaway, another well known Entomologist from Hawaii, visited India in 1915 and took with him live specimens of the parasite *Opius fletcheri*, S. and has reported the attempts with this parasite as a success in checking the melon fly *C. cucurbitae* found as a serious pest in Hawaii. It might be interesting to note in this connection that—in spite of the work of its parasites—the cucurbit or melon fly is one of the worst fruit fly pests all over India. The Australian Entomologist Froggat in his report on fruit fly studies, however, maintains the view that " while we succeed with parasites to a certain extent and in some instances for scale insects, aphis and even cutworms and other lepidoptera, yet under the present conditions of fruit growing, we will have to resort to other methods in reducing fruit fly pests." Some years ago, the writer had the privilege of spending two days with Mr. Froggatt in Bangalore and getting some information regarding his ideas on pest control by parasites and the writer is convinced that there are numerous difficulties for one to depend on that method of control for fruit flies. There are thus two different schools of Entomologists as far as this question of biological control is concerned.

The parasites generally attacking fruit fly maggots belong chiefly to two or three groups of wasps of which the sub family *Opiinae* appears to include a greater number of representatives than others.

Observations made on these parasites so far go to confirm the views of previous workers, viz , that the egg of the parasite is deposited in or upon the host larva in one of its immature stages and the host larva assumed the pupal stage before it is killed by the parasite and the parasitic grub pupated inside the puparium of the fly and emerged as an adult wasp where the adult fly would have emerged. Thus the fly is killed in its pupal stage. The essential thing for artificial breeding of these parasites is therefore a plentiful and perpetual supply of parasitised puparia of the fly pest.

The Future Outlook Regarding Fruit Flies in S. India. Landed proprietors and persons interested in fruit culture are nowadays evincing some interest in the production of various fruits both indigenous and imported, and all over the country large areas are now being brought under fruit cultivation. It will be advantageous to these people therefore to possess some ideas of the possible troubles that may arise from different kinds of insect pests affecting fruit crops and the consequent need for taking early steps to check them. This is all the more essential in the case of important fruits for consumption which are particularly liable to carry fruit flies of different kinds. In this connection, it might be pointed out that, one of the undesirable foreign insect pests which we do not want in India, (Ramakrishna Ayyar 1919) is the notorious Mediterranean fruit fly (*Ceratitis capitata*) and this creature has already invaded East Africa, S. America, Bermuda, Australia, Egypt and Palestine and it is perhaps only a question of time when it might get entry into India unless proper measures are taken to keep out this undesirable pest or the country and its conditions are exceptionally ceratitis proof. It may also be added that the Government of India have recently forwarded to all the Local Governments a copy of a Decree which has recently been issued by the Governor-General of Indo-China regarding importation of fruits into Indo-China, especiaaly in relation to this Mediterranean fruit fly. In the opinion of the writer, therefore, it is highly desirable in the interests of the fruit industry of the country that a regular survey of the fruit pests of the country is made so as to get some clear ideas as to what pests we already have in the country and which are the ones we have to guard against and that both external and internal quarantine regulations are promulgated by Governments to check not only the importation of infested foreign fruits but also to regulate the movement of infested fruit from one part of the country to another. We also know that there are plant diseases and quarantine regulations with special reference to fruit pests in many countries such as Canada, United States of America, Mexico, Australia, South Africa, etc. It is, perhaps, well known that fruit sellers from different parts of S. India are importing consignments of apples and other fruits from Australia and other countries where the Mediterranean fruit fly pest is found

and it is also found that parcels of apples, pears, etc., are got down even by post from Kashmir, Kulu and other Himalayan orchards where there is a chance of another undesirable pest—the San Jose scale (*Aspidiotus perniciosus*) lurking to be transported to the Southern plains. The Imperial Council of Agricultural Research has recently recognised the danger of the likely spread of this scale insect and has addressed the Madras Government suggesting that necessary measures may be taken to prevent the spread of this notorious pest. In a recent paper (Ramakrishna Ayyar 1933) the author has sounded a warning pointing out the danger of allowing undesirable plants and animals to enter the country and adding to our already existing troubles; this warning applies with special emphasis to some fruit flies and scale pests of fruits. It is therefore high time that proper precautions are taken to check such thoughtless and undesirable though often unconscious importations and the necessary quarantine laws introduced.

AN ANNOTATED LIST OF FRUIT FLIES AND THEIR PARASITES NOTED FROM SOUTH INDIA.

Of the various genera of fruit flies recorded from different parts of the world the most important ones from an economic point of view are (1) Ceratitis (including the notorious Mediterranean fruit fly *C. Capitata*, W.), (2) Dacus (including the olive fruit fly of Italy *D oleae*, G), (3) Chaetodacus (including some of the commonest Indian forms like the melon fly (*C. Cucurbitae*) fly, and the Queensland fly (*C. tryoni*), mango fly etc. (4) Rhagoletis (including the apple worm of America (*R. pomonella*), and (5) Anastrepha (including the Mexican orange worm (*A ludens*, L). The following are the species noted from South India till now.

Family *Trypaneidae*

Sub Family 1. *Dacinae*

This sub-family includes most of the common fruit flies found in this province. Of about nine or ten genera included in this group the genera *Dacus* and *Chaetodacus* appear to include some of the commonest of Indian fruit flies. No species of the genus *Bactrocera* have so far been noted from India though this name was wrongly used till recently for some species of *Chaetodacus*; the latter genus includes about eighteen Indian forms noted so far.

Dacus, F.

1. *Dacus (Leptoxyda) longistylus*, Wied. Found breeding in the fruits of the common plant *Calotropis gigantea* in different parts of the province. The fly has a dull reddish color with bright yellow bands on abdomen; the scutellum yellow; wings dusky brown narrowly along foremargin near apex. The female has a fairly long and conspicuous ovipositor; the fly is found to breed only on this host plant everywhere; it has been noted in different parts of Africa also in the same fruit. The Mysore Entomologist, T. V. Subramaniam, published an interesting note on the bionomics of this fly in 1916.

2. *Dacus brevistylus*, B. A small fulvous brown form with two large dark spots on the face. This is an African species and was first recorded from India from specimens in the Coimbatore collection reared from melons in the Ceded Districts; noted also on melons and Cephalandra fruits in Coimbatore.

Chaetodacus, B.

3. *Chaetodacus ferrugineus*, F. This species includes a few closely allied varieties though the different forms are often found in the same fruit. These

varieties are-typical *ferrugineus*, and varieties *dorsalis*, *incisus* and *versicolor*, the two of the former having been previously described as different species. The typical *ferrugineus* form has a more or less uniform reddish brown body without any dark mesonotal markings. This has been noted on mango in Salem and Godavari, on orange in Kotagiri, Nilgiris, 5000 ft.; it has been attracted to Clove oil and Citronella oil in Godaveri and Nilgiris. Previously noted as bred from Guava, Loquat, Pomelo and Peach in N. India and Burma.

4. *Chaetodacus ferrugineus dorsalis*, H. In this variety the head is red with dark spots Bred from mango in Coimbatore. Noted on mango, chillies, pomelo, etc., in other provinces.

5. *Chaetodacus ferrugineus incisus*, W. This is a very common form and found breeding on a variety of fruits. It has a general blackish color. Noted breeding in mango in Coimbatore, guavas in Bangalore and Nilgiris and in tomatoes, oranges and plums on the Nilgiris. Found also on wild *Solanum* fruits in Coimbatore; was attracted by isoeugenol and citronelia; found visiting *ocimum* flowers in Coimbatore and Nilgiris. It has been bred on Jak and *Careya arborea* fruits also from Coorg.

6. *Chaetodacus ferrugineus versicolor*, B. Very close to typical *ferrugineus*, F. Bred on mango in Coimbatore. Though it is possible to spot out the dark *incisus* variety fairly easily further structural studies have to be made with more material to clearly separate *ferrugineus* and the other two varieties *versicolor* and *dorsalis*.

7. *Chaetodacus zonatus*, Saunders. This species has been found to be synonymous with *persicae* of Bigot and *mangiferae* of Cotes. It is fairly small sized and of a uniform reddish brown color with yellow markings and only different from typical *ferrugineus* in the wing pattern. Noted on mango and *Eugenia* in Kistna district, Custard apple in Anantapur and on melons and *Hibiscus rosasinensis* in Bangalore, Nilgiris and Coimbatore; found attracted to Clove oil in Godavari. The writer has also collected the fly on the Bababuddin Hills, Mysore, 4,700 ft. It was also bred on *Careya arborea* fruits in North Malabar and Coorg. It is recorded on Bilva (*Aegle*) fruits from Coorg and in bottlegourd from Central Provinces.

8. *Chaetodacus correctus*, B. This species erected by Bezzi to rename a form which he named as *zonatus* in 1913 is very close to the latter but with some distinct differences in color and minor structural features. Bred from fruits of mango, guava, *Zizyphus*, *Murrayia* and sandal in Coimbatore and *Eugenia* in the Nilgiris; it was also attracted to Clove oil in the Nilgiris.

9. *Chaetodacus diversus*, Coq. This is known as the three striped fruit fly due to the striking yellow markings, The female has a fairly longer ovipositor compared to that of the other allied species; collected from Godavari, found on cholam leaf in Coimbatore and bred from mango in numbers in Bangalore. It was originally noted breeding on oranges. Noted by Shroff in bananas in Burma.

10. *Chaetodacus maculipennis*, Dol. A very distinct form with affinities to *diversus*; has four scutellar bristles. Fly collected on cholam in Coimbatore; appears to be a rare species in South India.

11. *Chaetodacus cucurbitae*, Coq. This is a very common and large species having a very wide distribution all over the tropics. It was first described by Coquillet from larvae in cucumbers in Hawaii (1899). It has a reddish brown color and the wings show fuscous markings. It is found breeding in all cucurbitaceae—chiefly bittergourd, luffa, cucumber and melons. This is the well known Indian fruit fly figured by Lefroy and Fletcher and is the commonest of the fruit flies attacking vegetables. It has also been reared from stem galls on *Coccinia* in Coimbatore and from *Nux vomica* fruits in Malabar. It is regarded as a very serious pest in Hawaii.

12. *Chaetodacus caudatus*, F. This fly was bred out from snake-gourds by the author in 1908 in Coimbatore. Recently noted to breed in *Coccinia* fruits in the Siruvani Hills, Coimbatore, 2,000 ft. was collected also from the Shevaroys, 4,000 ft. and from Taliparamba, Malabar. It is a large form different from many other species in having four scutellar bristles.

13. *Chaetodacus scutellaris*, B. Described by Bezzi from a single specimen collected by Fletcher from South Mysore in 1913.

14. *Chaetodacus bipustulatus*, B. General coloration is dark brown and the wings are hyaline with no dark markings. Very rare; only noted till now from Mysore and Nilgiris.

Mellesis, B.

15. *Mellesis nummularia*, B. A small reddish wasp like fly with an oval dark spot at apex of forewing; a rare species. It was found attracted to Clove oil in the Nilgiris slopes.

16. *Mellesis crabroniformis*, B. Originally described by Bezzi as *Monachrostichus crabroniformis* from a solitary specimen collected at Yercaud on the Shevaroy Hills, 4,500 ft.

Sub Family 2. *Trypaneinae*

This sub family includes, among others, the notorious Mediterranean fruit fly (*Ceratitis capitata*, Wied.). This is a serious pest of fruits in various parts of the world and one which has always to be guarded against. Though it has not as yet been noted in India, we cannot say when it may enter India in the near future unless very strict precautions are taken.

Carpomyia, A. C.

17. *Carpomyia vesuviana*, A. C. This is a small yellow black spotted species with distinct cross bands on the wings. It is commonly found all over the province breeding in both wild and cultivated *Zizyphus jujuba* fruits and is a fairly serious pest on the cultivated long fruited variety in Kurnool and other districts, though occasionally found parasitised by small wasps. It is a well known pest of this fruit in the Central Provinces and Khare [1922] has written a paper on this insect. It is also known from the Mediterranean areas.

Stictaspis, B.

18. *Stictaspis* sp. A stout black spotted species with banded wings has been collected from the Western Ghats by the writer. Another fly was recorded by the writer from bamboo shoots on the Nilgiris. Both these appear to be species of Stictaspis.

Callistomyia, B.

19. *Callistomyia pavonina*, B. A reddish brown insect with distinctly banded wings; a single specimen collected in Samalkot, Godaveri

Senior White [1924] records the following species also in his catalogue of Indian Trypaneidae in addition to the species noted above *Gastrozona melanista*, B., *Acidia fossata*, F., *Sphenella indica*, Sch., *Tephritis brahma*, S, and *Trypaena asteria* from different parts of South India.

PARASITES NOTED ON SOUTH INDIAN FRUIT FLIES

Opius fletcheri, Silvestri. Noted on different species of *Chaetodacus*. A medium sized glistening uniformly testaceous brown species. Very commonly found on the cucurbit fly (*Chaetodacus cucurbitae*).

Opius incisi, Silvestri. Similar to the above but with some dark markings on the abdomen; found on species of *Chaetodacus* attacking plums, etc., on the Nilgiris.

Biosteres compensans, Silvestri.

Biosteres persulcatus Silvestri.

Biosteres sp.

Trichopria sp.

Microbracon fletcheri, Silvestri.

Bathyanlax trypaneiphaga, Ramakrishna. Found on Chaetodacus on Alangium fruits.

Bathyanlax carpomyiae, Ramakrishna. Found on the Zizyphus fly *carpomyia*.

Gahan, in his paper on Opiinae, is of opinion that the genera *Biosteres*, F. *Diachasmimorpha*, V., are the same as the genus *Opius*, W. The writer is also inclined to believe that Silvestri's *Bracon fletcheric*—a Bathyanlax is same or very closely allied to the writer's *Bathyanlax trypaeniphaga*. Further studies are being made in this direction and it is the writer's idea to gather further material for a paper on the bionomics on these parasites.

The above list is by no means a complete one since, in the Coimbatore, collections, there are still a few which have to be studied and identified; nor can we say that we have collected all the fruit flies inhabiting South India.

The writer is indebted to the Imperial Institute of Entomology, London, for help in getting the identifications of many of the flies and parasites confirmed and for naming some doubtful species submitted to them. The published papers of Prof. Bezzi, the well known authority on these insects have also been used in the preparation of this list.

Literature Cited.

1. Ayyar, Ramakrishna, T. V. (1919) "Some foreign insect pests which we do not want in India"—*Agri. Journ. Pusa*, XIV.
2. „ „ (1921) "Some insects recently noted as injurious in S. India"—*Bull. No. 101, Imperial Dept. Agr. Pusa.*
3. „ „ (1927) "Parasitic hymenoptera of economic importance from S. India"—*Bull. Ent. Res. London*, XVIII.
4. „ „ (1933) "The economic danger in the introduction of some foreign animals and plants"—*Madras Agr. Journ.*, XXI.
5. Bezzi, M. (1913) "Indian Trypaenidae in the Indian Museum"—*Memoirs of the Indian Museum*, III (3).
6. Froggatt, W. W. (1908) "Report on a world tour in connection with fruit flies"—Published by the *New South Wales Department of Agriculture.*
7. Fullaway, D. T. (1919) "Control of melon fly in Hawaii by parasite introduced from India."
8. Howlett, F. M. (1912) "The effect of citronella on two species of *Dacus*"—*Trans. Ent. Socy.* pp. 412—418.
9. Khare, J. L. (1922) "Ber fruit and its fly pest"—*Bulletin No. 143 of Pusa.*
10. Senior White, R. (1924) "Catalogue of Indian Insects—Part IV Trypaenidae—*Government of India Publication.*
11. Silvestri, F. (1914) "Report on African expedition in search of fruit fly enemies"—*Bulletin No. 3 of the Hawaiian Board of Agriculture and Forestry.*
12. Subramaniam, T. V. (Mysore 1916) "Note on the Calotropis fly"—*Bombay N. H. S. Journal* XXIV, pp. 613—614.

SOUTH INDIAN VILLAGE STUDIES

A Preparatory Study of "Villur", Village No. 119, in Tirumangalam Taluq, Madura District, Madras Province.

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I. Social and General.

Introductory. The Madura ryot is usually a farmer in a very small way owning less than 6 acres of land. The fact that since the famine of 1876–78 no relief works or gratuitous relief have been necessary shows that he is generally industrious. Tirumangalam taluq has hardly any irrigation tanks or channels and possess but few wells, so that it is more at the mercy of adverse seasons than any other part of the district. Of late the number of wells have increased. Eighty to ninety per cent. of the cotton of the district is grown in this taluq. In the north of Villur, the *regar* soil is exclusively found while red sandy loam prevails in the east. These are owned by the *Telugu*-speaking *Reddis* who are good farmers. The soil to the south and west is much inferior and good farming is rarely found.

Location and administration. The ryotwari village of Villur comprises of four other smaller settlements in close proximity. It is about 20 miles south of Madura, the headquarters of the district. Tirumangalam, the taluq headquarters, is 10 miles to the north, where there are the usual judicial, revenue and police offices. The sub-registrar's office, police and railway stations are at Kalligudi four miles from the place. The establishment at Villur consists of one Village *Munsif* (headman), one *Karnam* (accountant) and eight servants. Besides, there are a *Panchayat* court, a post office and a stamp vendor. Recently a *Panchayat* Board has been organised at Maravarpatti, one of the settlements.

Climate. The village is a level expanse without any hill, forest or river within a radius of 7 or 8 miles. The climate is hot, dry, unhealthy and variable. The temperature for the district ranges between 100·1 and 68·6°F and the annual mean humidity is 70·2. The total annual rainfall for the taluq is 30–40 inches. The daily velocity of the wind varies between 129·6 and 69·6 miles in the year. Dust storms and whirlwinds occur not infrequently and gusty irritating winds blow from various quarters towards the end of March and the beginning of April. Except at these times and during the monsoons the state of air is calm and undisturbed, often to a painful degree. The wind from the north sometimes causes some injury to the crops by blight; but this happens only in exceptional seasons.

Population. (a) Numbers. In the 1931 Census Report of Madras, it is mentioned that "None of the cities can produce a density equal

to that of Villur or Sathangudi in Tirumangalam taluq of Madura. Both are good sized villages of over 3,500 inhabitants, the former almost reaching 5000". The following table shows the population figures of the village from 1891.

Table 1.*

Year.	Males.	Females.	Total.
1891	1657	1790	3447
1901	1646	1780	3426
1911	2018	2192	4210
1931	2470	2530	5000

About 4000 or four-fifths of the whole population are residing at Villur. One settlement is very small having only two houses with a few members in them. The other three have a few hundred people in each. There is always a preponderance by 8 per cent. of the females over the males with a steady increase of population from 1901. This increase is one of the main causes of the fragmentation of holdings and the exrteme poverty of the cultivators; the production of food fails to keep pace with the increase in population. The landowning cultivators are slowly turned out of their holdings to swell the ranks of landless labourers and the unemployed. On the other hand the number of non-cultivating proprietors taking rent in money or kind is increasing.

(b) Characteristics of the villagers. People are generally honest and trustworthy. But for the mutual trust and confidence that exist among the majority, the large number of transactions that are being carried on cannot take place. Hospitality is a common feature in every community. The villager is generally respectful; he knows his place in society. He is industrious and thrifty and is content with the barest necessities. The energy and life evinced particularly by the *Ahambadiyas* who constitute more than 50 per cent. of the whole population, is remarkable. This energy unfortunately runs to waste, sometimes into positive mischief. A section of this community has not yet given up their criminal instincts, and are a fear to their own community. The desire to live better is widely prevalent as is evidenced by the preference for a full meal with rice, vegetables and dhal to the cereal porridge with which most of them were content before; the males have begun to use shirts and coats; the number of *pucca* houses is increasing. These improvements are often obtained at the expense of capital, not from surplus income. For the good will does not always find the right way, as the observation, reasoning and intellect necessary are lacking. Though there are about 50 *pattas* paying land-tax over Rs. 30 a year and a dozen over Rs. 50 each, (vide table V) there is hardly one family in the village which can be said to live in ordinary comfort. The estate of the common cultivator, exclusive of land and its produce, is hardly more than Rs. 200 in selling value. The annual

* These and other figures which follow are taken from the Resettlement Register of the village, 1920.

expense of more than 80 per cent. of the families has to be within the cash value of Rs. 100, much less than the charge incurred per head in the prisons. This poverty certainly degrades them. There seems to be a habitual reliance in general upon parochial relief rather than upon their own industry. The labourers are worse. No wonder the villagers are looking, united only in this, backward instead of forward.

(c) The communities. The major portion of the people are *Ahambadiyas*. They have a bad name for crime. They closely resemble the *Maravans*, whose reputation for criminality is also notorious, but in their manners and customs they follow the *Vellalas*. *Ahambadiyas* 'commit but little crime in Madura'. Most of them in this village are farming in earnest and the foremost cultivator at present is one of this class. They have got a strong corporate feeling. About half of them are owner-cultivators and the rest are labourers. In Maravarpatti the inhabitants are mostly *Naickans* and *Sanans* who are not criminal and are steady cultivators. There are about a hundred families of *Vellalas* who specialise in the betelvine and do not interest themselves much in other crops. The *Chettis* generally trade in distant cities in such commodities as rubies and pearls. As a rule they get on well in these places, but none of them have any idea of forsaking their village home. Many of them are well off and have purchased the major portion of the lands surrounding Villur, while a few have also taken to cultivation. Almost all the *Brahmin* families have decayed leaving a few who are dwindling. They still hold a considerable portion of the lands though their interest in cultivation lags day by day. There are about a hundred members of the untouchable community who are good labourers, and a few families of workmen and village servants.

(d) Managing proprietors. The *Brahmins* (20 houses) and *Chettis* (150 houses), who are generally managing proprietors or absentee landlords, indulge by tradition and custom in rather expensive ceremonies such as marriages. They stick to a better status of living even when their present income does not warrant it. Their womenfolk do not substantially help in any productive manner, but are used to wearing costly jewellery. The extent of land in possession of the *Brahmins* has greatly diminished as many have sold them away and left the place, whereas the other community has acquired a good deal lately. These latter offer obviously enormous prices for the land as this is their sole investment. Moreover, having cash in hand, and being in contact with the *Ahambadiyas* they have maintained a litigant atmosphere in the place.

(e) Owner-cultivators and owner-labourers. The regular owner-cultivators (666 holdings) are generally *Ahambadiyas*, *Vellalas* and other communities. Their holdings vary from 2 to 8 acres each. Their living is the simplest and the man possessing above 5 acres, even

hopes to make a surplus in the favourable year, if the family is not too big. Unfortunately owing to poor agricultural conditions and the rapid increase of population, their number is decreasing. The owner-labourers (361 holdings) are chiefly *Ahambadiyas*. They hold from half to two acres each. The income from this bit of land is supplemented by working for wages. No undesirable habit is to be found among both these classes and when by any chance they get a surplus they go in for a hut or a plot of land.

(f) Labourers. The labourers numbering more than 500 are on the increase. They are mostly *Ahambadiyas* and partly untouchables. They do not get themselves trained for any particular work and there is no organisation to look after their interests. Many of them have gone to the plantations in Ceylon and other places, where permanent work is available. They have mostly stuck on to these places and the number of those who have returned is very few. Even now they go out in batches during the seasons. The work sought outside is preferably agricultural, but sometimes includes woodcutting, stonecutting, cooly work, etc. The *Ahambadiya* is capable of more hard work but is less skilful, and demands more wages. There are three common grades of wages; the adult male gets six annas a day, the female four annas and young boys or girls two to three annas. Rarely does the cost of male labour go up to eight annas. For ordinary agricultural purposes such as planting, weeding, etc. the rate is less and usually paid in kind. Reaping and threshing are paid also in kind as so much per unit of land. Cash is paid for such work as picking groundnuts according to work turned out, while picking cotton is paid for in kind. Cash wages are always preferred. The village is hardly self-sufficing for its labour and a good deal of complaints is made in this respect. Due to rise in the general level of comfort and unfavourable agricultural conditions, the farmer finds the agricultural wages high. As a matter of fact sometimes the labourer is better off than the cultivator.

Religious features. All the people are Hindus and purely Dravidian in religious sentiment. There is a temple dedicated to Krishna which is run by the *Brahmins* and numerous other small ones here and there belonging to others. Festivals are celebrated almost every month in the big temple and all communites partake in it. The enthusiasm for these however has of late diminished a great deal, mostly for economic reasons. There seems to be no strong attachment to religion prevalent now. Pilgrimages are very rarely undertaken to distant places like Rameswaram or Tirupathi. Religion does not affect the economic life of the people in any way, nor does untouchability.

Health and hygiene. The villagers are ordinarily healthy and seem to have adjusted themselves splendidly to the natural conditions prevailing. The mark of hard work is stamped on every adult, male or female, but poverty and under-nourishment are patent everywhere.

The *Brahmin* and *Chetti* women are not of so robust health as the *Ahambadiyas*, due probably to the fact that they do not work outdoors. Infant mortality is common but by no means high. No trained midwife is available within ten miles. Though it is common for people to go out for treatment, in no case is the help of the midwife sought. The average span of life is between 50 and 60 years.

Fever of more or less malignant types is common. Both intermittent and occasionally remittent forms occur accompanied by rigor or shivering fit. It however yields readily to ordinary treatment. Diseases of the digestive system are more prevalent. Diarrhoea and dysentery are met with frequently at all times in the year. Bad and insufficient food, insufficient clothing, filthy habits of life, irregularity in the hours of taking food and the frequent use of hot condiments seem to be the chief causes. Owing to the presence of unaltered masses of starchy food, there is a sense of weight or fullness in the stomach, or pain and discomfort after eating. This is often the beginning of chronic ailments. Rheumatism, both muscular and neuralgic, is rather prevalent. It occurs in the cold season, and is attributed to sudden chills, consequent on habitual exposure to cold and damp. Otitis is common. Conjunctivitis prevails very generally in the hottest months, especially after long droughts. Small-pox is prevalent as a sporadic disease. Asthma is rare and seldom of an aggravated type; elderly people are occasionally troubled with a chronic cough of an obstinate kind. Itches are very common in children and adults suffer from ringworms and various skin diseases, all due to insanitary surroundings. Due to mishandling of the various instruments, cuts and wounds are frequent. Mosquitoes are plentiful and in certain seasons are a great menace in the nights. Bites due to rats, scorpions, bees, ants, and poisonous snakes are fairly common. There are a few quacks dealing in indigenous medicine in the village or nearby, who are resorted to for the medical needs. There was a rural dispensary at Kallupatti and one now exists at Kalligudi. These are not sufficiently known in the village and few go there for relief.

The sanitary condition of the village is of course deplorable. Every house is no doubt well swept including even the front of houses. But as all the sweepings are thrown in the middle of the street or heaped in the corner, without arrangements for their removal, the dirt spreads immediately and is blown into houses. There are no latrines, not even for women.

Housing. The *Chettis*, whose traditional occupation is to go out to distant places for trade, live generally in *pucca* houses. Though much money is spent on them, they are ill-ventilated, dark and unhygienic. Such houses have increased of late and there are a few two-storied ones also. This increase, we are informed, is due to the fear of incendiarism and is not to be taken as a sign of any real prosperity, at any rate of the cultivators. The other communities

are hardly able to afford anything more than one bed-roomed cottages. Excepting in the lanes meant for the *Brahmins* and *Chettis*, there is a great deal of dearth of dwelling houses and consequent overcrowding. The drainage is very bad, and there is lot of dirt and avoidable disease. None of the lanes are lit at night. The passages are uneven and in a very poor state.

Water-supply. There are six wells situated in different places providing drinking water. Only two of these are well constructed; others require rebuilding and improvement. They are generally used in summer when the ponds dry up. The water found in them is very seldom of really first-rate quality. Though that obtained from the ponds is worse, it is preferred to well water as it saves the lifting and has a sweetish taste. The big pond is rather preserved from much abuse; yet it is so apparently unhygienic that even the villagers themselves hesitate to use it. It is never cleaned properly. Other ponds are used for washing clothes, performing ablutions, bathing or washing animals. The water is stagnant, filled with weeds and the banks are dirty.

Diet. All people who can afford to take rice do so and its consumption has increased greatly. It is boiled and eaten hot or cold with salt, *chatni*, *curry*, etc. Wealthier people mix ghee with it and use pepper water, curds and butter milk in moderation. Rice is also ground into flour from which cakes and sweetmeats are prepared. All available vegetables are freely taken. Milk is rarely used except by babies. The common diet of the poorer classes is a sort of porridge made of *cholam*, *ragi* or *cumbu*. It is usually made very thin and eaten cold, flavoured with salt and a *chatni* made of tamarind, turmeric, chillies and garlic. Salt fish are fondly taken, eggs are rarely used. Now and then some mutton, fresh fish or chicken form part of the curry.

Clothing. In the case of men two pieces of white cloth are used, coarse or fine according to the means of the individual; each from 4 to 5 yards in length and ¾ to 1½ yards wide. Of these one is wrapped round the body and the other is used chiefly out of doors as a spare cloth to throw on the shoulders or worn loosely in the form of a turban on the head. Shirts are increasingly worn and there is a tailor in the village. Women wear only one cloth which varies in length from 6 to 9 yards and in width from 1 to 1½ yards. It is usually coloured red. Those of the better classes wear a tight fitting bodice. Young children have scantier clothing or none.

Education. There are three elementary schools, one of which is meant for girls only. Attendance in all of them is very poor and it is difficult to see even one boy in the year continuing his studies after the elementary classes. The girls' school and one boys' school are under the Taluq Board, and the other is run privately with annual

grants from the Educational Department. The former are of recent origin and have trained teachers. The private school is the oldest and has been in existence for over 30 years. The female pupils are mostly *Brahmin* or *Chetti*, and they are sent there to keep away from doing mischief at home. The *Ahambadiya* boy is the greatest sufferer in this respect. His parents think least of education and employ him for their own assistance from very early years. Another elementary school has been under private management for some years in Maravarpatti which, after the establishment of the *Panchayat* Board there, has been taken over by that body. This has the services of a trained teacher.

Literacy is very poor, and nobody with college education lives in the village. Only about 300 individuals know how to read and write the vernacular. About a dozen men who were somewhat educated, have got employed as teachers or clerks outside. Just half a dozen people in the village know English. People show great eagerness to hear news about happenings in the outside world but there is hardly a single person to satisfy their curiosity. Though the desire for education is not absent in any community, yet the general poverty acts as a serious deterrant for them to take active interest in it. Due to absence of any form of literature, whatever literacy is gained is soon lost. There is no library or reading room and no one gets any newspaper even in the vernacular.

Social disturbances. Thefts and cattle-lifting were very common in this place and have not yet abated. The *Ahambadiyas* are the chief perpetrators of crime. About thirty years ago they picked up a trivial quarrel with the *Chettis*, and looted and plundered their houses in daylight. In consequence the whole community was rounded up by a contingent of reserve police and most of them imprisoned. A punitive tax was also imposed for some time. This had the desired effect. A few of them are now educated and some have acquired property. But a number of them who are not able to make a living by honest means, manage to cause considerable annoyance to peaceful cultivators. Cases of murder are not uncommon among this class and the community does not try to check them and others fear to unite against them. Setting fire to haystacks and house-breaking are common. Even those who suffer by them fear to come forward to give direct evidence.

Gambling is carried on to a small extent. The people however are entirely sober and even *tari*-drinking, so common in other parts of the district, is unknown in this village.

Indebtedness. Borrowers are for the most part men driven to this necessity by the pressure of want, and contract debt as a desperate resource without any fair prospect of ability to pay. Not infrequently money is also borrowed for agricultural purposes, e. g., buying bullocks, digging wells &c. Agriculture has not, for various

reasons discussed elsewhere, resulted in any remarkable successes; there is lack of stimulus in this direction. The cultivators usually have no cash in their hands in the cultivating seasons, and the result is a very acute and distressing 'money famine'. At the time of paying taxes also difficulty is felt as all produce are not immediately sold. It is mostly for these reasons that the small cultivator borrows money and the extent of indebtedness due to social habits is comparatively small. There are no professional money-lenders in the village. Loans are obtained by mortgaging movable or immovable property. The current rate of interest is from 12 to 18 per cent. per annum on secured loans and from 18 to 25 per cent. on unsecured loans. Such transactions take place very often as there are 5 or 6 document writers in this place spending their whole time in this work. There are many instances in which people have had to succumb to debts, though not to any viles of their creditors. The main reasons were that the particular debtor was unthrifty or the income from his land continuously fell short of his expectations.

Pastimes. It is very regrettable to note that no pastimes have at any time existed in this locality for men, women or children. People meet on ceremonial occasions such as marriage or death, for a short time, and there is some enjoyment on certain of the auspicious days in the year. The rough sport of bull-baiting was conducted for a few years long ago, but there is not much chance of its revival. Itinerant story-tellers and some local drama troupes visit the village occasionally. The cultivators have few likes and dislikes and their leisure is generally idled away.

Agricultural and Economical.

Soils (a) Surveys. The first regular survey and settlement of this village was carried out in 1890 and the resurvey and resettlement in 1910. The total area is 4450·87 acres of which the village sites cover 37·44 acres and the poramboke which includes tank-beds, channels, roads, etc. covers 713·85 acres. About 22 acres are unoccupied and the remaining 3677·87 acres are under cultivation. The lands are divided into 552 survey fields which are grouped into 26 blocks according to their being similarly circumstanced.

Classification of soils. The soils of this village fall under the two main series: (i) The regar or black cotton series extending over 1820 acres, underlaid by a basaltic eruptive sheet. They have the character of an alluvial backwater or lake deposit. They are of unusual depth without change of tint; they crack wide open during the dry seasons on account of their high clay content, and the soil is thus partly inverted by the surface soil falling into the cracks. The contents of lime, magnesia and alumina are uniformly high; potash has a wide range-it rises very high (1·14 per cent.) in the maximum while the average is fair; nitrogen content is very low.

The red ferruginous series covering an area of 1860 acres, form underlying dark-coloured mostly eruptive rocks. Some of these are very rich in lime and potash, others very poor. But compared with the regar on the average, the lime, potash, ferric oxide and phosphoric acid content is uniformly low.

The different classes and sorts to which both these soils belong are shown in table II. It will be seen that there are 471·26 acres (12 per cent.) of 'black clay–best', containing more than ⅔ clay. This soil is best suited for dry cultivation, particularly for cotton. About 58 per cent., i. e., 2164·39 acres comprise of black and red loam, containing from ⅓—⅔ clay. These are divided into best, good or ordinary according to the amount of organic matter present in them. The rest 1061·59 acres contain less than ⅓ clay. Much of the lands are above ordinary and very well suited for irrigation. A common feature, however, in both the series is that there is much of saline ingredients (called 'kalar' or 'uvar' in the vernacular) which makes the lands unfit for cultivation till they are neutralised or removed. Diminution of the size of leaves, assumption of cylindrical or spiral forms, dense hairy covering, resinous exudations and general compact growth are found in the trees which grow freely on waste lands. The chief salt met with is the washerman's earth, for removing which no satisfactory methods are known.

Table II.

Showing the classification, description and extent of lands.

Series, class and sort. Vernacular names.	Description.	Wet		Dry		Total.
		Taram	Extent	Taram	Extent	
Regar or black cotton series. 3—1 Best *Karisal.*	Black clay containing more than ⅔ clay. Grayish black soil, quite free from stones, granular.	...	...	1	471·26	471·26
4—1 Best *Kakkarai.*	Black loam containing from ⅓ to ⅔ clay. Friable dull earth, free from stones, in big lumps.	3	32·43	2	850·99	883·42
4—2 Good *Pottal.*	Do. Considerable quantity of saline ingredients.	4	145·17	3	243·34	388·51
4—3 Ordinary *Veppal.*	Do. Light greyish brown earth, lumpy and saline ingredients.	5	60·19	4	15·64	75·83
Red ferruginous series. 7—1 Best *Sevval.*	Red loam containing from ⅓ to ⅔ clay. Greyish brown colour. In big lumps and saline ingredients.	4	87·92	3	362·89	450·81
7—2 Good *Saralai.*	Do. Light brown colour. Granular, in small lumps.	5	246·91	4	96·00	342·91
7—3 Ordinary *Saralai.*	Do. Sandy, coarse.	6	16·16	5	6·75	22·91
8—1 Best *Manal.*	Red sand containing less than ⅓ clay. Light brown earth.	...	...	4	1061·59	1061·59
	Total. ...		588·78		3108·46	3697·24

In the regar tracts the surface soil of black clay exists to a depth of a yard and in the red series it prevails to a shorter depth. Below this for another 3 or 4 feet gravelly or calcareous soil is found and still below, the earth consists mostly of rocks of various kinds or red earth. It will thus be seen that the moisture of the surface soil is readily drained through the subsoil.

(c) Productivity of soils. According to their 'grain values' or productive power, the wet and dry lands have been grouped into *tarams* as shown in table II. The wet lands of the village fall into 4 tarams, 3 to 6 (table III).

Table III. Wet lands.

Taram.	Extent in acres.	Grain value in Madras measures* of paddy per acre.	Assessment in Rs. per acre.
3	32·43	815	8—2—0
4	233·09	723	6-14—0
5	317·1	631	5-10—0
6	16·16	540	4—6—0

The dry lands belong to the first 5 *tarams* in the district (table IV).

Table IV. Dry lands.

Taram.	Extent in acres.	Grain value in Madras measures* of cholam and cumbu each half, per acre.	Assessment in Rs. per acre.
1	471·26	211	2-12—0
2	850·99	178	2—0—0
3	606·23	162	1—8—0
4	1173·23	146	1—2—0
5	6·75	130	0-14—0

Those dry lands which have a well in them are called garden lands. There are on the whole 600 acres of wet lands (irrigated), about 600 acres of garden lands and 2500 acres of dry lands (unirrigated). The assessment per acre on wet lands varies from Rs. 8—2—0 to 4—10—0; on dry lands from Rs 2—12—0 to 0—14—0; garden lands are classed as dry and no special rate is levied.

(d) *Soil improvement.* Hundreds of cartloads of tank silt are applied every year to the inferior kinds of red soils in dry or garden lands. Black silt is mostly used, red silt being less available. In wet lands the level has to be lowered from time to time to facilitate irrigation The earth thus removed is also applied to dry lands. Where saline ingredients occur a special crop is rarely grown. Nothing is done for dry saline soils, and they are simply left uncultivated.

(e) *Location of the settlements with reference to soils.* All types of soil and all the tanks are accessible within a mile of Villur. The roads and markets are also nearer. Hence it is most favourably situated so far as agricultural purposes are concerned. The two settlements in the south have little wet lands near them and there are few wells for irrigation. But they possess the better dry soils and cotton is their

* One Madras measure of paddy weighs 2·5 lbs. of cholam weighs 3·1 lbs. and of cumbu weighs 2·7 lbs.

valuable crop. This is one of the reasons for the slightly higher prices for lands in Villur than for the corresponding ones in the settlements.

(f) *Relation between soil fertility and welfare of the cultivator.* The sole source of income is agriculture in this locality, no other handicraft being found in any of these places. But the villages to the north and east of Villur, which possess exclusively the regar or red soil of the best sort, are certainly much better off. The black soil being very retentive of moisture, does not depend so much on the rains, the outturn of the crops is steadier and larger in quantity. In the case of Villur and other villages to the south and west, the soil is mixed, inferior kinds of black and red series, which though very well suited to irrigation, produce practically nothing in the absence of proper rains. Though the people have tried to make the best of the situation as far as their knowledge and facilities permitted them, the results are far from satisfactory.

(To be continued)

Proceedings of the first meeting of the Crops and Soils wing of the Board of Agriculture and Animal Husbandry in India.

25th February to 2nd March 1935.

Sixty-seven members including officials and non-officials from the different Provinces and States attended the meeting besides three visitors. On the first day when the full board met Diwan Bahadur Sir T. Vijayaraghavachari, chairman, welcomed the members and gave a brief outline of the features in the agricultural development of the country since the previous Board met in 1929.

Of the ten subjects on the agenda, the first six were referred to sub-committees which met on the 25th afternoon, 26th and 27th and submitted their reports to the General Board which met for 3 days, 28th February, 1st and 2nd March. The other subjects were discussed by the full Board directly.

The subjects and the reports of the sub-committees adopted by the Board are given below :—

Subject I.—*The planning, technique, and interpretation of field experiments and the technique of cultivation.*

(a) To review the methods of experimentation and interpretation at present in use and to consider their suitability to the varying soils, crops and climatic conditions in India. (b) To consider to what extent the standardisation of field plot technique throughout India is possible ; also the standardisation of methods of statistical analysis (c) The need for experimental work on field plot technique so as to permit refined methods of statistical analysis to be applied to the results and to reduce avoidable experimental error to the minimum. (d) The methods of testing new varieties of sugarcane in vogue at different experiment stations and the possibility of securing greater uniformity. (e) To discuss the conditions under which the inter-culture of rain-fed crops is beneficial. (f) The effect of the speed of various cultural implements on the tilth of the soil.

The committee reported that the modern methods of experimentation and interpretation of the results were being followed in all provinces. Fisher's analysis of variance was commonly used. Very little information was, however,

available as to the suitability to varying soils, crops and climates of any particular method of lay out. After pointing out the comparative merits of the latin square and the randomised blocks in experiments, the committee thought there were different types of experiments which had to be considered and that standardisation of method was not possible nor desirable. They recommended that the results of experiments should be stated in a standard form giving essential particulars.

As regards (c) the committee considered that research was needed to the technique of field experiments and recommended investigations on some particular complex types in different provinces. To assist in co-ordinating this work it recommended the formation of a standing advisory committee of Imperial Council of Agricultural Research.

(d) With regard to testing of sugarcane varieties 13 specific recommendations were made which seemed to cover the subject and particular attention was drawn to the one regarding the size of plot to be used for sugarcane variety trials. The committee considered that further research work was desirable on the size and shape of plots required for preliminary trials, semi-final trials and final trials.

(e) Regarding intercultivating there was very little scientific data available to the committee and it appeared that except in specific instances, there was no advantage from inter-culture to an extent other than that required to remove weeds. The committee recommended further experiments in this line of work.

(f) The committee had no information except one note by the Imperial Agriculturist, Pusa, and in the opinion of the committee the question of the desirability of rapid ploughing was entirely one of cost and the factor of the depreciation of machinery running at high rate of speed should be taken into account.

Subject II.—*Soil surveys and Soil analysis.*

1. (a) Soil classification and mapping in India. (b) Soil surveys in relation to new irrigation projects, their scope and the methods to be employed. (c) The optimum soil conditions for the major crops and the degree of variation permissible. (d) (i) Standard methods of soil analyses for India, (ii) Standard methods of estimating the percentage of in-organic colloids in soils.

2. (a) The root systems of cultivated plants in relation to soils ; and (b) The effect of Hydrogen-ion concentration on the development of the root system of certain crops.

The committee considered that an all-India soil survey based on agricultural needs was desirable and would be of considerable benefit. To properly organize such a survey the committee recommended the formation of a Soil Bureau attached to Imperial Council of Agricultural Research for the purpose of collating and co-ordinating the data already available and to receive all future data and systematise the work as a whole. While the Bureau might direct the survey, the actual work would have to be organised on a provincial basis. They recommended that at first the survey to be made should be a broad, general and simple one on climatological basis and had given details of the data to be collected. They suggested that sampling should be made about 50 miles apart. The committee considered that monoliths of soil types should be kept in the Soil Bureau for reference.

Regarding 1 (b), the committee emphatically recommended that no new irrigation project should be initiated until a thorough soil survey of the area likely to be affected had been made and the data considered. The committee also recommended that in the Province a scientific staff be maintained whose duty will be to study the changes that were being brought about by irrigation which might cause the soil eventually to deteriorate for crop-production.

Regarding 1 (d) the committee recommended that the Imperial Council of Agricultural Research be asked to appoint a committee that shall define methods

of soil analysis and it should consist of agricultural chemists and University representatives who were investigating related problems.

2. (a) and (b). The committee recognised the desirability for the more detailed study of root development in soils and recommended that the Imperial Council of Agricultural Research should incorporate in all crop schemes, that they now or in future initiate, a study of the root development of particular crops.

Subject III—*Soil Amelioration.*

(a) To consider the advances already made in the control and prevention of soil erosion and the steps to be taken for the further study of the problem with special reference to agricultural methods of improvement. (b). Recent advances in alkali land reclamation. The amelioration by cropping, manuring or irrigation of soils with an abnormally high pH. (c) The effect of river silt on soils.

The committee thought that one of the main types of erosion calling for their consideration was that associated with the Jumna river along the banks of which in United Provinces heavy ravining had taken place. To remedy this the committee proposed (1) the erection of bunds in the fields at the head of ravines to prevent the ravines cutting back further into the high land, (2) that the work on this question should be systematised by a formation of 'ravining code' for the protection of such areas, and (3) encouraging the growth, particularly in the monsoon, of strong covering crops on the lands at the heads of these ravines. The committee also stressed the importance of the stringent regulations of all grazing and cutting of timber on the lands surrounding the heads of ravines in these areas.

Regarding the type of erosion to be found in Bombay—Deccan and Central India considerable work had already been done, Schemes were working successfully but the main difficulty was the financing of such schemes. Where interest rates were high the committee considered that it might be possible to bring such schemes within the scope of famine relief works.

Regarding erosion in plantation areas the problem was being tackled successfully, terracing being done immediately after afforestation.

(b) and (c). The committee reviewed the work being carried on by the Agricultural Department in Sind and by the Research Division of the Irrigation Department. A soil survey has also been concluded over the whole Barrage in which the detailed distribution of *Kalar* had been noted. The problem was being tackled by three methods:— (1) Application of heavy doses of water to wash the salt down (2) Growth of suitable crops in suitable rotation, and (3) Application of chemical correctives as gypsum, calcium chloride etc.

In Punjab the Irrigation Research Institute had carried out successfully on a large scale experiments on the reclamation of canal-irrigated land gone out of cultivation due to excessive alkalinity by adopting the above methods. Moreover this Institute was collaborating with the Punjab Agricultural Department in a survey of the area to be commanded by the 'Haveli' canal project. The committee recommended that such soil surveys should be undertaken and the results reviewed before any large irrigation project was sanctioned.

The committee after considering the question of soils which were not classed 'Kalar' but in which the pH. was distinctly high and where particular varieties of cane thrived, recommended that information should be collected on the relative tolerance of different strains of improved crop, namely cotton, cane, rice and wheat to soil alkalinity as such information was of general importance and would be of considerable practical value.

(c) As regards the effect of river silt on soil the committee was of opinion that any improvement manifested by the application of silt was due primarily

to improvement in the mechanical and physical texture of the soil rather than to manurial constituents in the silt. They considered that local experiments should be carried out particularly in areas recently brought under canal irrigation if there were reasons to believe that the silt was in any way deleterious.

Subject IV.— *The maintenance of soil fertility with special reference to the maintenance of the nitrogen level by green manures and composts.*

(a) Recent advances in green manuring practice; the most suitable green manuring crops; green crops in rotation with swamp rice; the economics of green manuring. (b) The comparative value, from the point of view of nitrogen recuperation, of different leguminous crops, when grown in rotations. (c) The relative value of various methods of preparing composts. (d) The effect of heavy crops, e g. of sugarcane, on soil fertility.

Regarding (a) the committee recorded the progress generally made in green manuring practice and the chief features governing the value of green manuring on the different common crops. These points were dealt with under field experience and effective utilisation in practice. The committee then gave the information available about the different crops which were being used as green manures and the conditions where the practice was most valuable. The factors relating to the value of green manure were then dealt with. A point that emerged was that for green manuring, a crop need not necessarily be a leguminous one, as the important consideration seemed to be the amount of organic matter that was incorporated in the soil. The committee had then suggested various lines of research that might give information of value. Among others, there was need for further research on the question as to whether non-leguminous crops were as good as leguminous ones and on what part of the plant was more effective as green manure.

Regarding (b) the committee had very little information before it and felt that there was ample work still to be done. Though the committee realised that the selection of this or that leguminous plant in a rotation was not governed purely by its recuperative value, suggested that the many established rotations in which alternative leguminous plants appeared to figure, provided material on which their relative recuperation value might be more closely studied than hitherto appeared to have been done.

Regarding the various methods of composing the committee considered the relative merits of the three main systems adopted, the Indore, Fowler and Adco and came to the conclusion that Indore method in a simplified form as practised to-day, was easy to carry out and seemed more suitable for general conditions among the cultivators. Fowler method was more rapid and essentially at its best dealing with town waste The Adco process, was of value where tillage was largely mechanical and cattle to supply the necessary dung and urine required by the other methods might be a limiting factor.

Regarding (d) the committee had no doubt that the heavy crop of improved varieties of canes was having a definite effect in reducing fertility of soils except where the general standard of cultivation and manuring was improved to meet their needs. In certain parts only the good ratooning power of the Coimbatore canes had been made use of without any regard to cultivation and manuring. This depletion of the soil fertility, the committee considered, could only be remedied by the agricultural departments being given sufficient personnel to carry out the propaganda for better cultivation and manuring that was necessary.

Subject V.—*A review of the organisations existing for agricultural propaganda and other extension work.*

(a) The best means of bringing the results of experimental work to the notice of cultivators with special reference to the wider use of improved

technique in cultivators' practice. (b) The most suitable methods of securing the rapid extension of new crops, especially improved varieties of crops, into general cultivation, the organisation required for this purpose, and for securing an adequate premium for quality during the early stages of a new crop or variety. (c) The methods found most useful in preventing crop deterioration caused by the continuous use of home-grown seed. (d) Experience gained in the establishment of college graduates on agricultural holdings with Government help and under departmental guidance. The value of such holdings for demonstration purposes and seed production.

A strong and influential committee consisting of all the Provincial Directors of Agriculture and non-officials discussed this question and put forward the undermentioned resolutions which were approved by the Board. Regarding item (b) the committee came to the conclusion that it was a question to be investigated by the new marketing section of the Imperial Council of Agricultural Research.

Recommendation : I.—In view of the fact that propaganda has not kept pace with research and of the necessity for getting results of research home to the actual cultivator, we recommend that :—

(1) in every province the number of demonstration plots on cultivators' land should be increased ;

(2) the subordinate staff of Agricultural Departments in the districts should be strengthened particularly the staff of demonstration maistries or *Kamdars* or *Mukkadams* ,

(3) the staff of agricultural departments should receive special training in the methods of propaganda by the institution of short courses of instruction and that a course on publicity methods and propaganda should be included in the curriculum of agricultural colleges ;

(4) the propaganda relating to all the departments dealing with rural development should be co-ordinated and that Provincial Governments should entrust a special officer with this duty and also with the duty of intensifying propaganda work in the Departments of Agriculture ;

(5) broadcasting should be introduced wherever possible for the purpose of agricultural and rural reconstruction propaganda and for giving the cultivator direct information as regards the prevailing prices of agricultural produce.

(6) The Imperial Council of Agricultural Research should be asked to undertake a study of propaganda methods in India and other countries and circulate the information from time to time to all Provinces and States concerned ;

(7) The Imperial Council of Agricultural Research should be asked to investigate the question of the formation of a Central Cinema Institute for making films of general and provincial interest as well as to investigate the various methods of distributing and exhibiting them in rural areas.

II. We recommend the extension and co-ordination of associations like the Better farming and Better living Co-operative Societies of the United Provinces and the Punjab, the Village Farmers' Associations of the Punjab, the Taluka Development Association of Bombay, and the rural reconstruction centres in many provinces for the purpose of attacking the problem of agricultural development and rural reconstruction on the widest possible front.

III. We emphasize the need to organise education, elementary and secondary so as to provide an agricultural bias in the former and agricultural training to a majority in the latter with a view to co-ordinate education with the needs of agriculture.

IV. We recommend that the State should encourage agricultural graduates and educated youth with practical agricultural training to settle on cultivable

waste land and conduct agriculture on improved lines and, in order to enable them to do so on an economic basis, the State should give them such financial help as may be needed for the initial reclamation of the land and also lend on easy terms the capital required for carrying on the industry.

V. We recommend the preferential employment of agricultural graduates in departments of Government other than agricultural such as the Revenue, Co-operative and the Irrigation Departments as their agricultural training would make them specially effective in the discharge of their duties.

VI. We recommend that an Expert Committee may be appointed by the Imperial Council of Agricultural Research to investigate the causes of crop deterioration caused by the continued use of home grown seed.

Subject VI —*The water requirements of crops.*

(a) To review the information now available regarding the water requirements of Indian crops and to make suggestions for future experimental work. (b) The Selection, or breeding, and subsequent introduction into cultivation of varieties of crops better adapted than existing varieties to the limitations of irrigation water supplies, with special reference to quick maturing types.

The committee first recommended that the data with reference to water requirements of crops so far as they existed in the different provinces should first be examined statistically before new experiments were started. The committee drew special attention to the experiments going on in the Punjab and Sind and suggested that the work in other centres should be so co-ordinated as to benefit from the results obtained at these places. The committee felt that in laying out experiments the main consideration should be the optimum yield which could be obtained with a given quantity of water and not the maximum out-turn for a given acreage. The committee also drew attention to one of the aspects not included in the Sind and Punjab experiments, viz. the influence of the date of sowing and range of sowing and planting period for various crops on the economic and efficient use of water.

Regarding (b) the committee considered that the selection and breeding of crop varieties was a subject which must be experimented on locally, and that attention should be paid not only to the production of improved varieties but to the introduction of new species so as to make a better use of the water available. The information at present available was scanty and it was recommended that the Imperial Council of Agricultural Research should first collect and publish such information through the Bureau proposed in subject VII or otherwise.

The General Board in adopting the committee's report passed a resolution "The Board desires to draw attention to the local Governments to the success which have been achieved in Madras, the United Provinces, and the Punjab Irrigation Boards in the co-ordination of agricultural and irrigational research, for the consideration of new irrigation projects and all measures designed to promote the more efficient supply of water to crops."

Subject VII.— *To consider whether a Bureau of Plant Introduction should be established in India, under the Imperial Council of Agricultural Research or otherwise, for the controlled introduction and testing of new crops and for the exploration of promising regions in the search for the new species.*

This subject was discussed by the full Board and the three points of consideration were (1) whether a Bureau of Plant Introduction should be established, (2) if such a Bureau was to be established what would be its functions and (3) what should be the relation of this Central Bureau with the Province. After considerable discussion the Board adopted the following resolutions:

(i) In the opinion of the Board, a Bureau of Plant Introduction will be of great value; (ii) The function of the Bureau would be (a) to facilitate the

controlled imports of new species and varieties of crop plants and other plants of economic importance; (b) to assist explorations as and when required in India and other countries; and (c) to investigate methods of securing control of plant introduction. (iii) The Imperial Council of Agricultural Research may be invited to formulate a scheme for giving effect to these proposals.

Subject VIII:—*To consider,* (a) *what further measure should be taken for the improvements of the Indian fruit industry*; (b) *the need for a central fruit bureau and* (c) *the prospects of fruit-canning in India.*

The Board adopted the following resolutions.

(i) "That this Board desires to emphasize the value of fruit growing to Indian Agriculture. It notes that the Government of India through the Imperial Council of Agricultural Research is financing many extension schemes of fruit research and comprehensive marketing surveys. It also notes that in some provinces the Agricutural Departments have been able to do a good deal to aid fruit growers by research, demonstration, the provision of nursery stock and assistance in organization. It desires to emphasize the importance of agricultural departments being placed in a position to render adequate assistance to fruit growers by the provision of expert staff and finds to ensure the provision of such facilities as those described above."

(ii) "That this Board recommends that special courses of training in scientific fruit and vegetable growing be started in all the Provincial Agricultural Colleges."

(iii) "That this Board would like to draw the attention of Local Governments to the advisability of registering all nurseries producing fruit trees for sale to public."

Subject IX.—*Agricultural Marketing.*

The Board after considerable discussion adopted the following resolutions:—

(i) "That in the opinion of this Board the scheme for the improvement of marketing agricultural produce recently put into operation by the Government of India and outlined in the Government of India's resolution No. F. 16-M/34 dated 10th January 1935, is calculated to be of the greatest benefit to Indian Agriculture".

(ii) "That this Board is also of opinion that the organization described in resolution (i) was well designed and the programme of work was suitable to immediate needs."

(iii) "That this Board considers it very important that the collection of adequate statistics should be borne in mind by the new marketing section in carrying out its scheme of work."

Subject X.—*The influence of cheap Hydro-electric power on agricultural development.*

It was pointed out that in the Western United Provinces the cheap current provided had very greatly assisted the development of local agriculture. The cheap current was being used mainly for two purposes, one for pumping back into canals water which had leaked into *nullahs* and other depressions alongside the canals and secondly for pumping water from a large number of tubewells which had been sunk in the area. These tube wells formed very important centres of agricultural development. Improvements in cultivation were following the tube wells to such an extent that the Irrigation Department had now agreed to the supply of fertilisers on credit to the cultivators taking water from the tubes. The latest development in this regard was the adding to the water as it leaves the tube of ammonium sulphate solution calculated to supply one maund of ammonium sulphate per acre to growing sugarcane. It appeared that

the great success so far achieved depended almost entirely on the cheapness of the current, and that there were still enormous potentialities in many directions. The cost of raising water by electric current was about half that of raising it by bullock power. Irrigation from these tube wells costs Rs. 11 to Rs. 12 per acre for sugarcane, and Rs. 3 per acre for wheat. At these rates there was a very great demand for water and the difference in the economic prosperity of the people of the tract was already very marked. The current costs about 7 pies per unit to generate and was charged to cultivators at one anna per unit for agricultural purposes.

After some discussion the Board adopted the following resolution. "That this Board views with appreciation the success of the Hydro-electric scheme in the rural areas of the Western United Provinces, and commends it to the notice of other Local Governments."

At the end of the meeting on 2nd March, the Chairman thanked the various representatives of the Irrigation Departments, Universities and other visitors for their attendance and valuable work on the committees, the technical secretaries and the president and secretaries of the various sub-committees. He stated that it was clear that the Imperial Council of Agricultural Research had formed an exceedingly valuable element in the work of the Board, in that it existed as a permanent body able often to implement the resolution passed by the Board. He noted with great pleasure that the Government of India was proposing to allot to Provincial Governments one crore of rupees for expenditure on rural uplift, and considered this a most valuable sign that times were improving and hoped that it might become in time a regular feature of the Central Budget. He was of opinion that impending constitutional changes would improve the standing and position of the Provincial Departments even more than it did before and concluded his speech by thanking all the members for their kindness, courtesy and consideration.

Rao Bahadur Ramaswami Sivan, claiming to be the oldest member of the Board thanked the President for his excellent Chairmanship during the Board's meetings. The meeting then terminated. K. R.

RURAL RECONSTRUCTION AND RELIEF TO THE UNEMPLOYED

By T. ALAGAR

The cry of the hour and the need of the day is to concert measures for reconstructing rural activities and absorbing the young and educated youths of the country in Agricultural pursuits and it is at the proper time that the Village reconstruction programme of Mahatmaji and the Government have been put forward.

It is a well known fact that thousands of educated young men are wandering about the country in quest of jobs to eke out their livelihood, their ambition in life being service of one form or another. The undersigned, who is a commercially qualified man and who has held responsible positions in life, is now devoting himself entirely to Agriculture and earnestly desires to help youths who may feel the spirit of the times and who may be willing to work in the fields from morning to evening and toil for themselves and for humanity. It will be an independent method of living, besides being an eye-opener to others already in the line and demonstrate clearly that Agriculture is a noble calling providing ample scope for exercising one's industry, forethought, skill and knowledge of various arts and sciences. The example set by Russia and a study of how she has

advanced in agriculture should serve as an incentive for the youths to take to the land and to afford relief to the unemployed.

An obliging friend has placed at my disposal 150 acres of land nearly, admirably suited for Agriculture, situated at about 4½ miles from Srivilliputur, S. I. Ry. and by the side of a trunk road with carts and buses plying at all times. The local agricultural demonstrator inspected the lands and found it to be fairly rich and eminently suitable for intensive cultivation. The help of the demonstrator and of other officers of the Agricultural Department would be available.

Educated youths, agricultural students and unemployed overseers and others desirous of taking to Agriculture either as a hobby or as an avocation may find work as regular agriculturists on the farm without any obligation other than that of cultivating the lands by themselves on a co-operative basis, meeting the annual land revenue and a small return to the land-owner.

It is to be hoped that a colony of workers will be established on a fixed and permanent tenure and as such it is requested of those interested in Agriculture to respond to the call, join the colony in large numbers and work for themselves and for the colony.

It is also requested that philanthropic gentlemen, public bodies and the Government, interested in solving the problem of unemployment to make the unemployed take to Agriculture and allied branches as fruit culture, vegetable gardening and cottage and rural industries, and to support and encourage the formation of such a colony by giving technical advice, adequate facilities and financial assistance.

The formation of the colony requires investment of money for reclamation of lands, sinking of wells, supply of manure, cattle fodder and wages of labour, and steps are being taken to appeal to the Government, local bodies, public institutions, and benevolent gentlemen for the necessary financial assistance.

All correspondence and enquiries may be addressed to Mr. T. Alagar, C/ of the Technical Institute, Srivilliputhur, S. I. Ry.

Research Items.

A Malformation Disease of the Nandyal Cottons.

By K. KAMA Rao, L. Ag., and L. NEELAKANTAN, B. A. (*Hons.*)

In the cold months of December-January, when the indigeneous cottons begin to flower, a few peculiar looking plants have been noticed during the last three seasons at the Agricultural Research Station, Nandyal. The disease has also been noticed here and there in the neighbourhood but the ryots do not seem to take much notice of it, though a few places are found to be badly infested, as for example between Maddikera and Guntakal along the railway line. The disease is known to the ryot as *Bingi thegulu*, *Bingi adhika thegulu*, or *Yerra thegulu*.

The first prominent feature observed is a change in the leaf colour, the healthy green turning to a copper red or almost pink or crimson. The underside of the veins, the leaf margin and tips are the first portions to show the first symptoms which gradually spread inwards till the entire lamina is changed. This discolouration generally starts in the bottom leaves and progresses upwards. Almost simultaneous with this change the leaf blade bends down gradually, with the tips pointing to the stem and displaying a tendency to expose the lower surface.

Sooner or later the diseased leaves drop off and clusters of leaves greatly reduced in size appear in their axils and as the disease progresses, flower formation is arrested. In mild cases the progress of the disease is often checked by the

prompt shedding of leaves, in the early stages of the attack. But only a few bolls develop with ill-developed kapas and further production of bolls is hampered by the excessive leaf shedding at the outset. In a few plants the attack is confined to one or two branches, the rest of the plants being free. In the virulent forms, the plant is practically sterile and the flower buds that manage to appear are malformed. The corolla is highly atrophied and the calyx and involucre exhibit pelory in varying degrees. In rare cases a few flowers are seen which are smaller in size and wither quickly after opening. Most of the anthers are contabescent and the pollen grains in the few good anthers are smaller in size than normal. Attempts to cross normal plants with such pollen were in vain. On testing for viability, it was found that while normal pollen burst in distilled water ejecting their contents within 60–100 seconds of immersion, depending on the stage of development of the grain, corresponding pollen from the diseased plant failed to burst even after 180 seconds. Thus even though stray flowers may develop, they are useless as the few pollen grains formed are abnormal and physiologically inert.

The Nandyal malformation would appear to be similar to the 'Brachysm' of Punjab and the 'Cyrtotis' of Bombay in affecting the crop, and to differ from them in symptoms and incidence. The streaks of yellow colour on the leaves that give a characteristic mosaic appearance as noticed in the Punjab are absent here. The incidence is confined to the local indigeneous cottons as in Bombay. But the pink colour that develops in the leaves just before flowering and particularly rapidly during cloudy weather in the early sown cottons is a notable feature of the Nandyal disease.

On the farm, the disease has been observed both in *indicums* and *herbaceums*, the incidence being comparatively more in the former. The hirustum type (Cambodia) grown here both under dry and irrigated conditions has been free, though a mere red colouration in stray cases, without any other grave symptoms, is not uncommon. Among the indicums, almost all the strains tested on the farm are susceptible to varying degrees with the exception of one strain (N. 449) observed to be practically free during the last two seasons. The standard cotton of the station N. 14 is the worst sufferer.

The causes of the malformation are not clear. The plants are free from insect pests. Specimens of diseased plants sent to the Government Mycologist, Madras last season for examination were reported to be free from fungoid attacks. The observation that late sown plots are comparatively freer and that the disease generally spreads in cloudy weather just before the flowering season indicate that the causes are to be sought for elsewhere.

The significance of the disease cannot be over-estimated as the sterility often associated with it would seriously affect the final yield. Results of counts made in N. 14 grown on the farm show that 14% of the plants are affected by the disease, of which 4 to 6% are in the advanced stages. The percentage of attack was only 2 during 1933–34.

It is not known how long the disease has been here. There is no reference to it in the farm records during the earlier years. Considering that the disease has been observed in the farm and in the villages in the neighbourhood for the last 3 years, it may be that not before long the disease will demand more serious attention at the hands of the cultivator and the investigator.

Vernalisation—A new Technique in Agriculture.

Among the discoveries in pure and applied Sciences which have led to the development of Agriculture, 'Vernalisation' is the latest and ranks foremost in the wonderful possibilities it offers in the raising of crops. The classic researchs of Laws and Gilbert on the mineral nutrition of plants have led the way for the

augmentation of production by the application of artificial manures. The unearthing of Mendel's work on the laws of inheritance has not only advanced the methods of practical plant breeding, but has also laid the foundations of modern genetics. Lyssenko's experiments regarding the pre-treatment of seed material before sowing are said to have revolutionised Soviet Agriculture by making it possible to grow cereal crops like wheat, in places where it was not possible to raise a successful crop.

The term 'Vernalisation' is a new one and its original equivalent in Russian is 'jarovizatie' with several other synonyms as yarovization, jarovization, springification, springization etc., of which the most commonly used is 'iarovization'. All these signify a certain change in the cropping as the growing of winter cereals in spring etc 'Vernalisation' in its broadest aspects aims at removing climatic and geographical barriers which determine the nature and character of crops grown in particular regions and thus makes it possible to grow any crop anywhere. The immediate and most practical aspect of vernalisation claimed by the Russian workers is the shortening of the vegetative period of a crop and thus hastening sexual maturity. It has been possible by the special process of vernalisation to mature a wheat crop early without detriment to yield in certain regions where previously it was not possible successfully to grow a crop of wheat before the setting in of frost.

What then is vernalisation? This can be understood clearly if the principles according to Lyssenko which are responsible for plant growth and development are understood. It is generally known that the life cycle of a plant from seed germination consists broadly of two stages i.e., vegitative and reproductive, the former leading to the latter. The immediate aim of vernalisation is the shortening of the life cycle by reducing the vegetative stage without detriment to the reproductive stage so that the grain yield of the plant, when we are dealing with cereals, is not affected. These two stages are attained by the plant during its *growth* and Lyssenko conceives of *growth* as physiologically distinct from the *development* of a plant. *Growth* according to him is the simple increase in plant dimensions and while the *development* of a plant consists of various stages involving various physiological changes one leading to the other, without which the plant cannot complete its life cycle, i.e., cannot reach maturity. These changes he stresses are controlled by definite environmental factors as, light darkness, temperature, moisture etc., which in various proportions and combinations are essential for intitiating them without which the plant may not reach maturity, though it may exhibit the phenomenon of outward growth. With these principles of plant development, Lyssenko explains the phenomenon of *photo-periodism* in plants. Plants are grouped according to their reactions to light as short-day plants i.e , plants which will mature under short-day conditions, and long-day plants i.e., plants that mature under long-day-conditions and normal plants i.e., plants which do not react to the length of day. It was found that light was one of the chief factors affecting the flowering of the short and long day plants. Many varieties as soya-bean, maize, millet etc., do not fruit or ripen too late in Northern latitudes due it was thought to long-day conditions, prevailing there. While if these plants were exposed to short days by reducing the day light, these entered the fruiting stage earlier. In short, the acceleration or retardation of maturity in short-day plants depends upon the amount of short day or long day received by the plant in the earlier stages of development. It was argued that certain substances were formed in the short-day plants when they were grown under long-day conditions in the beginning, which inhibited the reaching of reproductive stage even if exposed later to short-days. Again it was found that by hastening the maturity by increasing the dosages of short days, the vegetative vigour was poor due it was supposed to the antagonism

existing between *growth* and *reproduction*. Lyssenko by his experiments has shown that what was required by the short-day plant in the early stages was a certain quota of darkness to enable the plant to reach maturity, and the want of which in Northern latitudes hindered the sexual maturity of short-day plants like millet, maize etc. This could be supplied in the amount contained in the normal day conditions i e. 12 hrs. of day alternating with 12 hrs. of darkness for a certain period of days after which the plant would reach maturity even if exposed to long-day conditions. The hastening of maturity which results in poor growth according to Lyssenko was not due to any antagonism between *growth* and *reproduction*, but was only due to want of enough light necessary for the assimilatory functions of the plant. With these ideas of plant growth and development he proceeds further, and the essence of vernalisation consists in the application of these ideas to the germinating seed. According to him the external factors conditioning the sexual reproduction in the cereals may occur, not only the green plants but also in a seed with an embryo which has just commenced development but has not ruptured the seed coat. And so these changes in plants conditioning sexual reproduction are independent of the size and the age of the plant without relation to the period and time of growth. It is this fact which makes the application of the principle of vernalisation practical to the agriculturist. The sowing material to be vernalised may have the appearance of the seed from the strict agriculturist point of view, but really should be regarded as seedlings according to botanical description. If such a material is exposed to the influence of the external factors as darkness etc., for the hastening of sexual maturity and is then sown under normal day conditions, vegetative development is not weak but is vigorous quite unlike the results obtained on the seedlings treated to such conditions mentioned under experiments on *photoperiodism*. Hence Lyssenko explains that no antagonism exists between vegetative growth and reproductive development.

The practical applications of these principles necessitates the undertaking of extensive experiments to determine the exact conditions that influence these stages so as to make the germinating seed get 'vernalised'. In Soviet Russia where experiments are still in progress published results show that they have succeeded practically in the hastening of maturity in crops like wheat, sorghum, cotton, etc. It has been found till now that the main factors which influence the changes during vernalisation are darkness, light, humidity and temperature. Other factors which may have influence may exist but not yet determined. The exact proportions of any one or combination of factors may have to be determined for each crop. The working details regarding vernalisation concern mainly about the treatment of the seed before sowing. The optimum requirements in seeds for vernalisation will be the beginnings of germination when the embryo has just commenced to pierce the seed coat. This condition should be maintained during the period of vernalisation which may be between 5 to 30 days during which time, the growth of the seed should be retarded so that it may not be inconvenient for sowing. Otherwise during the process of sowing as in handling and manipulation through seed-drills etc., the seeds may get injured seriously affecting the stand in the field. The retardation of growth in germinating seeds is effected (1) by the regulation of moisture content of the seeds and (2) by chemical means. In the former case previous determinations of minimum amount of moisture necessary for germination and arrest of growth thereafter without affecting the vitality of seed are necessary for the carrying out of this process on a bulk scale. Want of moisture will result in dessication of seed and too much moisture will result overgrowth and hence the regulation of moisture content during the process of vernalisation is a very important consideration. Again there is the danger from moulds coming on the seeds for which aeration and frequent stirring of seeds are essential. Since temperature

is one of the factors influencing vernalisation, this method of regulation of moisture content of seed has to be varied so that the adjustment of moisture conditions becomes complicated. Chemical methods are for this reason to be preferred. The principle of this method is the employment of salt solutions singly or in suitable combinations for soaking the seeds which when treated in low concentrations depending upon the seed material will without affecting germination, hinder the growth producing conditions suitable for vernalisation The details of the treatments etc., by both these means can be referred to in the Bulletin on Vernalisation published by the Imperial Bureau of Plant Genetics, 1933.

The applicability of vernalisation in India as well as in any other country of the world is of great importance in the National Economy if the ultimate possibilities of circumventing the ecological barriers are realisable. So far except in Russia reports are not very encouraging even in the hastening of sexual maturity of crops like cereals though claimed to be successful by Russian workers. Preliminary experiments carried out in Coimbatore in crops like millet, rice and cotton have not given any fruitful results so far. A set of detailed experiments regarding the physiological principles governing vernalisation is essential before anything could be said of this extremely useful application to Practical Agriculture. A compilation by the Imperial Bureau of Plant Genetics of the results achieved so far in various countries is being got ready.

N. P.

Gleanings.

The role of Sulphur in Soya Bean. Soya Bean plants deprived of sulphur in the soil get sick, and show it by turning yellow-green, and producing smaller leaves and thinner stems. These external symptoms, and an analysis of internal derangements due to the lack of sulphur, were described by Dr. Scott V. Eaton, of the University of Chicago. The external symptoms are similar to those caused by lack of other elements. such as potassium, phosphorus and calcium. Dr. Eaton explained that starvation in these necessary minerals interferes with the formation of one of the plant's indispensable enzymes, reductase, thereby preventing the plant from making use of nitrates, necessary for the formation of protein foods and the upkeep of its living protoplasm Stopped from this normal nutritional function, the plant piles up soluble nitrates and organic nitrogen compounds, as well as all forms of carbohydrates. Sulphur starvation thus apparently works its harm through causing starvation in other, quantitatively more important elements in the plant's life cycle. *Science* Vol. 81. P. 40.

Oxidising Agents as Fertilisers. Iyer, Rajagopala and Subrahmanian (Proc. Indian Acad. Sci 1, No. 2. p. 105) describe interesting effects of various oxidising agents on crop yield and certain chemical and biological transformations in the soil. Some remarkable increases in yield are recorded, up to 100 per cent, for example, with tomato plants on soil treated with manganese dioxide. Certain other crops responded better to potassium permanganate. Ammonification, with organic manures, was slightly favoured by oxidising agents, and increased oxidation of organic matter was demonstrated by the increased production of carbon dioxide corresponding to the loss of carbon. The treatment also resulted in a temporary increase in the numbers of bacteria and Actinomyces, whilst in some cases depression of fungi occurred. It appears that the results are due more to the facility with which the added substances part with their oxygen than to the effect of the metallic ion, hydrogen peroxide producing effects similar to those of manganese dioxide. Increased formation of bacterial food and consequent

increased activity may be involved as well as direct oxidation of organic matter to simpler substances and carbon dioxide. *Nature* Vol. 134, P. 940.

Longevity of Seeds. The question of the longevity of buried seeds is always recurring, as witness the recent revival of the fable of 'mummy wheat'. There is abundant evidence that the embryo of the wheat grain perishes relatively soon in ten years or less under ordinary conditions. Respiration goes on until the substance of the embryo is burnt away; extreme desiccation may prolong the process Other seeds, however, do retain their vitality for much longer periods when dry, and when buried in earth germination may be indefinitely delayed. Possibly the tension of carbon dioxide in the soil gases slows down the respiration process; again, we have found that humus particularly of deep-seated peat, contains substances inhibiting germination, even when the conditions of moisture, aeration and temperature are optimum.

This raises the fundamental question of whether the life of an organism can be suspended and pass into a static condition, to be resumed when the environment becomes favourable again. So far as our experimental knowledge goes, seeds are always respiring, considerably at first when they are drying off after ripening, but then more slowly, the machine just 'ticking over' as long as life remains.

If the essence of life resides in change, can there be a stop and a later resumption? On the basis of some continuing change, however minute, being necessary, how are we to account for the long dormant life of some organisms that possess a very small reserve of respirable material, as for example, the spores of bacteria which in the dry state have a very long recorded life? Some refined experiment seems to be needed to try whether in such cases respiration however, infinitesimal, is not still going on.

This is not the only unsolved question that the dormancy of seeds presents. Every farmer and gardener is familiar with the growth of certain weeds, notably charlock, which follows the ploughing up of land which may have been in grass twenty or thirty years. But why in an ordinary arable field, subject to charlock, do we get a rush of growth in one year and few or no seedlings in another? Why do other rare plants suddenly spring up in unexpected places? In Dr. Brenchley's experiments on the germination of seeds contained in soils taken at different depths from the old Rothamsted plots, the soil samples are exposed to optimum conditions of aeration, moisture and temperature, but years elapse before all the seeds germinate.

In the past abnormal season many unexpected 'weeds' have appeared in the John Innes gardens. Some are comparatively uncommon plants, that as far as is known have never been grown here: for example, Datura sp., Ambrosia artemisiaefolia, Physalis edulis, etc. It may be supposed the seed had been introduced in manure, but considering the rarity of the plants, that only shifts the locality of the problem. One piece of land here, after it had been cleared from sweet peas, has covered itself with Nicotiana seedlings. Nine years earlier the plot had carried Nicotiana, but in the intervening period not a seedling had been seen. We know something of the effects of 'Vernalisation' and of chilling in stimulating the germination of certain seeds which may otherwise refuse to start, but this dormancy of buried seeds still offers problems for experiment.

Nature, Vol. 134 P. 932–33.

Research and Teaching. There is no more noble profession, in my mind, than that of a teacher, with its marvellous opportunities for character building and training the minds of the younger generation. But in science, research must accompany teaching to prevent him from becoming a mere pedagogue—to keep his own mind from being relegated into that of a mere machine and from losing touch with the advance in his profession. *Science* October 1934.

Soil Survey in relation to Rainfall. The undertaking of a thorough soil survey which would link rainfall data to the water requirements of the plant—by assessing the importance of surface run-off, depth of percolation, fluctuations in level of subsoil water, capillary forces and other pertinent facts—should be as much an essential preliminary to the formulation of a water conservation scheme as the engineer's surveys of land levels and natural sources of supply. Rainfall is without doubt a useful statistics in certain cases, but without the relevant data concerning evaporation, rate of entry into the soil, and sundry other factors it is comparatively useless as an index of the amount of water available to the plant. The rapid strides which in recent years have been made in the field study of soil conditions in relation to vegetation should be taken advantage of by considering them in conjuction with meteorological records in the formulation of national schemes of conservation. *Tropical Agriculture*, October 34.

Lodging in Cereals. There is little information in the scientific literature regarding the precise effects of manures in causing or preventing cereals from lodging. Farmers generally assure that there is some connection between manuring and lodging, and frequently ask for advice as to a manurial treatment that will "strengthen the straw". That suitable manuring may strengthen the straw is supported by experiments carried out in Germany. In one investigation, potash starvation checked the growth of barley, and strenghtened the thickness of the epidermal cells. In a second, an optimum supply of nitrogen resulted in greater strength of straw; heavy phosphatic applications produced thicker and more extended cell walls and earlier development of the mechanical tissues. Potash also increased the strength of straw, but excessive nitrogen made the crop more likely to lodge. Other results suggest that a deficiency of nitrogen and phosphates may actually increase the strength of the lower internodes of the plant, and potash starvation, while increasing the strength of the lower internodes, decreases that of the middle internodes.

To some extent these findings are contradictory, but that is unimportant from a practical point of view, for several authorities point out that strength of straw is only one of a number of factors that determine resistance to lodging. There must also be considered, the rooting system, the elasticity of the straw, the length in regard to the strength, and the amount of the foliage. while it may perhaps also be suggested that the weight of the ear relative to each of the above factors must also be considered

On the chemical side it has been shown that the silica, ash and lignin content of lodged straw is reduced as compared with that not lodged, and that nitrate of soda, by depressing the ash and silica content may weaken the straw and cause lodging.

In the Guide to Experiments, 1934, of the Jealott's Hill Agricultural Research Station, it is stated that the addition of extra phosphates and potash failed to improve the standing capacity of wheat heavily manured with nitrogenous manures. A similar result was obtained at Sprowston in 1932, when barley was grown on land purposely heavily folded with sheep. Extra manuring increased lodging without increasing the amount of harvested grain.

Thus on rich soils manuring is not likely materially to assist crops to stand up to harvest.

On a poor soil, however, at the Craibstone Experimental Station, a complete mixture of artificials produced a better standing crop than an incomplete (and smaller) dressing, while potash and phosphates alone had no beneficial effect.

Similarly, in a three-years' experiment at Sprowston on poor soil (the average crop of barley without manure being about 4 quarters per acre) a complete

mixture of phosphatic, potassic, and nitrogenous manures improved the standing capacity of the barley. On better land the same treatment caused lodging.

The problem of lodging is really one for the plant breeder, but manuring obviously exerts some influence. Fortunately, there are signs that oats and wheats of improved standing capacity may soon be available. Then it will be safe to manure more heavily. It is, however, difficult to interpret in practical terms the results of the investigations into the effects of manures on the sturucture of cereals.

It is helpful to remember, in practice, that there is a maximum yield (which is likely to vary from year to year) at which all the present varieties of cereals will lodge. It does not matter by how much the application of manures strengthens the straw, or influences for the better any of the other attributes that prevent lodging, cereals will always lodge in bad weather if the yield is heavy enough

Thus provided the use of balanced manures does not cause the yield to exceed that limit (which is obviously a varietal characteristic) the crop will stand; otherwise it will go down. The danger point is reached more quickly on good than on poor soils, where balanced manuring would be expected to influence standing capacity over a greater range of yield increases. In the end, however the physiological limit to the standing capacity of the variety would be reached, and it would lodge as badly as on better land,

Actually, the use of manure in preventing lodging is limited, and it is unwise in practice to rely too much upon them. (*Journal of the Ministry of Agriculture*, Vol. XLI, pages 1114 to 1116).

Estate News.

Students' Examination—The University examinations for the 1st and 2nd year was over during the month. The third year examination is in full swing and comes to a close by the 2nd May 1935.

The Sugarcane Station Club Tournament. The fourth Annual open tournament conducted by the Sugarcane Station Club came off during the Easter Holidays. In addition to the usual Badminton, Fives and Doubles, Bridge, Ping-Pong and Carrom were the extra items included this year. The Tournament attracted quite a large number of entries for the various items.

In the Badminton Fives the Sugarcane Station C. Team supported by Raghu of Tanjore met and defeated after a thrilling fight the M. Y. M. A. team of Coimbatore.

For the Auction Bridge an unusually larger number of teams competed including some well known pairs from Gobichettipalayam. It is gratifying to note that in this item of the Tournament Messrs. Balasubrahmaniam and Viswanathier of the Agricultural Officers' Club reached the finals and after a close fight lost to Messrs. Sundararajan and Narayana Iyer the most formidable pair from Gobichettipalayam.

Some of the matches in Ping Pong were well contested. In Muthuswami—the Champion of the Agricultural College—who lost to Rangaswami Chetty we have a rising champion who with proper training ought to make his name heard in Table Tennis.

In Carrom which is the latest fad in indoor games several young boys played with considerable skill and two of these youngsters reached the finals with the least difficulty.

The boarding and lodging arrangements for moffusil competitors were satisfactory and every match during the Gala week attracted large crowds.

The prizes to the winners and runners up in the various items were distributed by Mrs. D. Ananda Rao.

Badminton Fives—Winners—Sugarcane Station C. Team.

Runners up—M. Y. M. A. Team, Coimbatore.

Bridge winners—Messrs. Sundararajan and Narayana Iyer of Gobichettipalayam.

Runners up--Balasubramaniam and Viswanathier of Agricultural Officers' Club.

Carrom Doubles. Winners—Messrs. Raman Menon and Venkatraman.

Runners up. Raman Menon's B. Team.

Ping Pong Winner—Rangaswami Chettiar.

Runner up—Muthuswami.

Weather Review (MARCH 1935).

Dry weather prevailed over the major portion of the country for the first half of the month. During the month, the North West Frontier Province and Kashmir were affected by no less than eight western disturbances. The first of these appeared on the 1st, caused scattered falls of rain in Beluchistan, Punjab hills and the Chota Nagpur. A second disturbance appeared on the 10th and passed away eastwards through the extreme north on the 12th after causing a few falls in the Kashmir, and local thunderstorm rains in the North West Frontier Province. A third one appeared on the 13th and in passing away eastwards caused cloud and rain in Kashmir and local showers in the North West Frontier Province. It disappeared on the 16th. The fourth disturbance caused cloud and rise in temperature along the North West Frontier Province on the 17th and moved away eastwards on the 21st causing local rain in the area. The fifth western disturbance which occurred on the 21st caused local falls in the North West Frontier Province and Kashmir and developed into a low pressure area over the Punjab on the 23rd. This caused nearly general rain or snow in Kashmir and local thunderstorms in North West Frontier Province and Beluchistan, and widespread dust storms over the Punjab. Another shallow low pressure formed on the 25th and in passing away eastwards caused general rain in the East Central Provinces, Bengal and Assam. Another disturbance approached the North West Frontier Province on the 26th and caused widespread thunderstorms along the North West Frontier Province, Kashmir and Western Punjab. It passed away eastwards on the 28th. Two more western disturbances affected Beluchistan one on the 29th and the other on the 31st, each causing rise in temperature and thunderstorms in the area.

Scattered falls of rain occurred in Orissa, Chota-Nagpur, Bengal and Assam on the 4th, a few light showers occurred in the South and East Bengal and South East Madras on the 5th Local falls occurred in the North Madras coast, Orissa, Bengal, Assam on the 6th and in Mysore and Lower Burma on the 7th.

Thunder showers occurred in Tennasarim on the 8th, 12th, 20th, 21st. Scattered thunder showers occurred along Orissa—Ganjam coast and in Coorg on the 8th, in Chota Nagpur and Burma on the 9th and in Assam on the 19th. Widespread thunderstorm rain occurred in Bengal and Assam on the 22nd. Thundershowers also occurred in East Bengal, Assam, Burma, and South East Madras on 23rd and in Chota Nagpur, Bengal and Assam on the 28th, 29th and 30th. A few thunder showers occurred in Bengal, south Hyderabad, Malabar and South East Madras on the 31st.

Temperatures were markedly below normal in the West Coast India, West Central Provinces and North Bombay Deccan on the 6th, in North West India on the 28th and in and around Rajaputana on the 30th.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0·7	+0·1	0·7	South	Negapatam	0·6	+0·3	5·7
	Berhampore*	1·2	+0·5	1·2		Aduthurai *	0·2	−1·1	3·8
	Calingapatam	0·2	−0·2	0·3		Madura	0·0	−0·6	0·7
	Vizagapatam	0·0	−0·8	0·0		Pamban	0·1	−0·4	4·1
	Anakapalli*	0·0	−0·1	0 0		Koilpatti *	0·0	−0·8	0·8
	Samalkota*	0·0	−0·4	0·0		Palamkottah	0·3	−0·6	2·4
	Maruteru*	0·0	0·0	0·0					
	Cocanada	0·0	−0·4	0·3					
	Masulipatam	0·0	−1·3	0·1	West	Trivandrum *	0·6	−1·1	3·4
	Guntur *	0·7	+0·6	0·7	Coast	Cochin	0·6	−1·4	1·3
						Calicut	0·0	−0·5	0·6
Ceded	Kurnool	0·0	−0·3	0·1		Pattambi *	0·0	−0·5	0·0
Dists.	Nandyal *	0·0	−0·2	0·0		Taliparamba *	0·4	0·0	0·4
	Hagari *	0·0	−0·2	0·2		Kasargode *	0·0	−0·6	0·3
	Bellary	0·0	−0·2	0·1		Nileshwar*	0·0	−0·3	0·0
	Anantapur	0·0		0·0		Mangalore	0·0	−0·1	0·0
	Cuddapah	0·0	−0·3	0·2					
Carnatic	Nellore	0·1	0·0	1·3	Mysore	Chitaldrug	0·1	−0·1	0·5
	Madras	0·0	−0·2	0·6	and	Bangalore	0·0	−0·5	0·1
	Palur *	0·1	−1·8	4·0	Coorg	Mysore	0·5	+0·2	0·5
	Palakuppam *	1·4	−0·2	3·3		Mercara	0·1	−0·5	0·8
	Cuddalore	0·0	−0·2	2·9					
Central	Vellore	0·0	−0·3	1·5	Hills.	Kodaikanal	1·3	−0·8	4·0
	Hosur cattle farm *	0·0	0·0	0·3		*Coonoor*	0·9		3·5
						Ootacamund *	0·4	−0·2	0·6
	Salem	0·0	−0·4	0·9		Nanjanad *	0·2	−0·5	0·3
	Coimbatore	0·0	−0·9	0·5					
	Coimbatore Res. Inst.*	0·0	−0·8	0·4					
	Trichinopoly	0·2	−0·3	1·0					

*Meteorological Stations of the Agricultural Department.

Weather Report for the Research Institute Observatory.

Report No. 3/35.

Absolute maximum in shade	99·3° F.
Absolute minimum in shade	62·3° F.
Mean maximum in shade	96·0° F.
Departure from normal	+1·5° F.
Mean minimum in shade	69 0° F.
Departure from normal	−0·4° F.
Total rainfall.	Nil.
Departure from normal	−0·8
Heaviest fall in 24 hours	Nil.
Total number of rainy days	Nil.
Mean daily wind velocity	2·9 m. p. h.
Mean humidity at 8 hours	64·7%
Departure from normal	··5·0%
Total hours of Bright sunshine	296·5
Mean daily hours of Bright sunshine	9·6

General Summary. Dry weather prevailed throughout the month. Days have begun to be very hot, the absolute maximum going up to 99·3° F. Humidity is in defect by 5%.

A. Subba Rao.

Departmental Notifications.

The following officiating appointments in the Madras Agricultural subordinate service—class i—Upper subordinate—iii grade, are ordered, with effect from 24th April 1935:— Mr. K. Rangaswami Iyangar, B. Sc. Ag., to officiate as Assistant Paddy section vice Mr. M. P. Narasimha Rao granted leave, to report to Superintendent, A. R. S. Maruteru. Mr. C. Ekambaram B. Sc. Ag., to officiate as Upper subordinate, Agricultural section, vice Mr. M. Gopal Unnithan on leave, to report to Dy. Director of Agriculture, IV circle. Mr. Y. Venkataswami, B. Sc. Ag., to officiate as upper subordinate, Agricultural section vice Mr. U. Uittal Rao on other duty in the Madras Agricultural service, to report to Farm Manager, A. R. S., Nandyal. Mr. C. Balasubrahmaniam B. Sc. Ag. to officiate as Upper subordinate, Agricultural section, vice Mr. T. S. Venkatarama Iyer on leave to report to Dy. Director of Agriculture, VI Circle.

Mr. Muhamad Basheer whose offg. appointment in the Entomology section will cease on 17th April is appointed from 18th April as temporary Assistant in Entomology in the Pemphres and Physiological scheme. Mr. M. Ramaswami Pillai, Sub Assistant, Paddy section is granted extension of service for one year from the 16th September 1935. Mr. G. Venkatanarayana, Assistant, Cotton section to be Assistant in the Oil Seeds section. Mr. P. Krishnamoorthi, Asst., Oil Seeds section and temporary Assistant in the Nadan Cotton scheme, to be Assistant, Cotton section without prejudice to his temporary appointment. Mr. T. Varahalu, Offg. Assistant Lecturer in Chemistry section is re-transferred to the Chemistry section. Mr. M. Narasimham, A. D. Chodavaram is posted as F. M., A. R. S., Samalkota. Mr. N. Ramadoss, A. D. Cocanada, on relief by Mr. S. Suryanarayana is posted to Srungavarapukota sub circle. Mr. M. V. Kondala Rao, A. A. D. Vizagapatam is transferred to Vizianagaram and Mr. N. M. Bukta, A. A. D. Vizianagaram to Chodavaram. Mr. M. Gopala Rao, A. A. D. Berhampur will look after the work in Aska sub circle also. Mr. B. Madhava Rao Patnaik, A. A. D. Aska is transferred to Anakapalle and K. Suryanarayana, A. A. D. Anakapalle to Parvatipur. Mr. S. Muthuswami Iyer, F. M. Hagari on relief by M. Vaidyanatha Iyer is re-posted to Siruguppa as A. D. Mr. M. Krishnaswami Iyangar on return from leave is posted as A. A. D. Adoni and Mr. Nagadara, A. A. D. Adoni is transferred to Guntakal. Mr. E. N. Rangaswami Iyangar, A. F. M. Kalahasti, is transferred to district work in Cuddalore division. Mr. R. Kochukrishna Pillai, Assistant, Chemistry section is granted leave for 25 months and 15 days from or after 15th August 1935. Mr. M. P. Narasimha Rao, Assistant, A. R. S. Maruteru is granted l. a. p. for 2 months from 24—4—35 Mr. V. K. Kunhunni Nambiar, F. M. A. R. S. Kasargode is granted l. a. p. for 2 months from 25th February 1935. Mr. M. Eggiaswami Iyer, A. D. Tindivanam is granted l. a. p. for 4 months from 24—4—35 or date of relief. Mr. K. Kannan Nambiar, A. F. M. Pattukottai is granted l. a. p. for 2 months from 8th April 1935. Mr. M. Gopala Chetty, A. D. Hosur, is granted l. a. p. for 3 months from 24—4—35.